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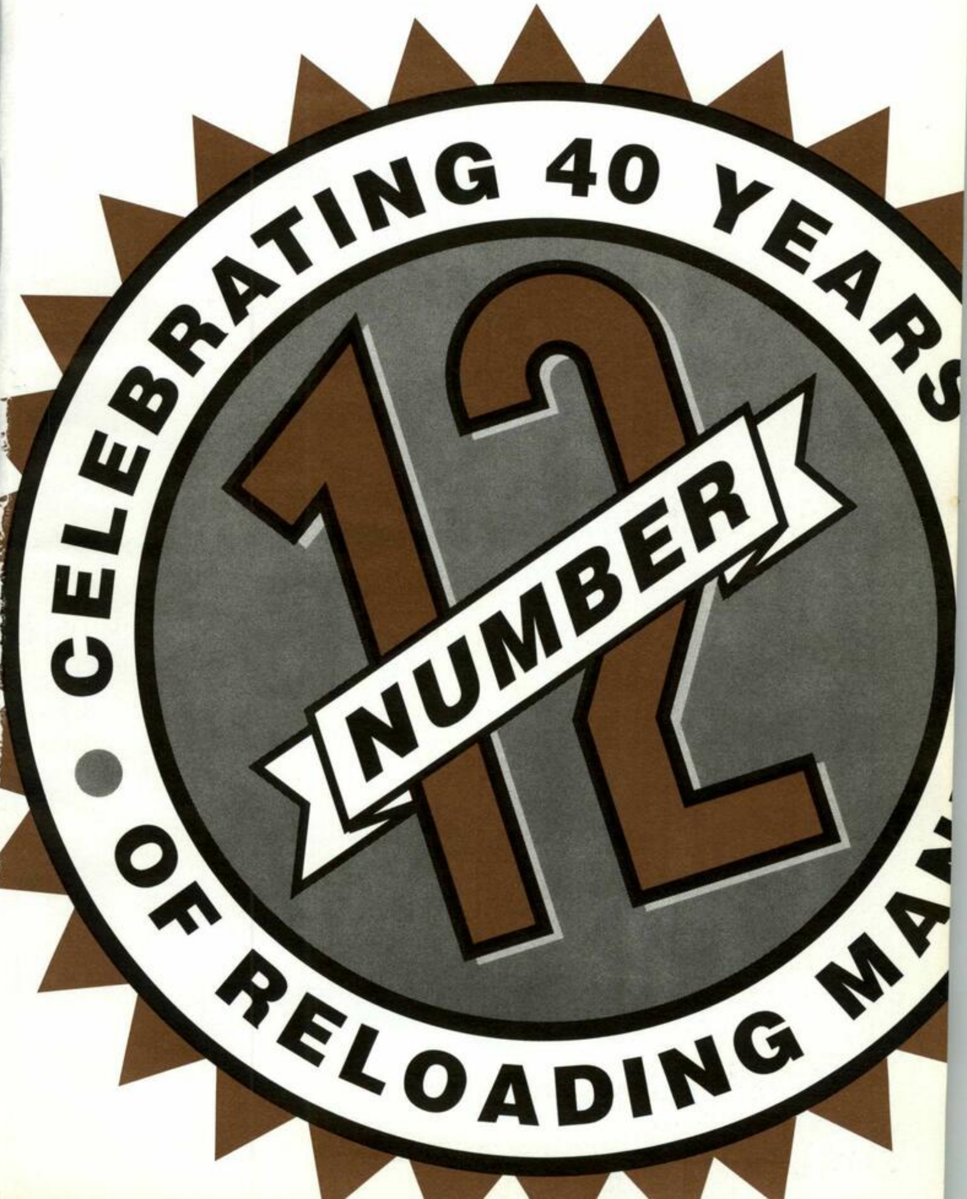
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DISCLAIMER

These loads are for Speer bullets. Bullets of other makes will not produce the same pressures and velocities.

All data contained herein is intended for use by persons familiar with handloading practices and their own loading equipment. If you are uncertain as to the operation of your equipment, contact the equipment manufacturer for additional assistance. New reloaders are strongly urged to read and understand the text of this manual. It has been written to give clear instruction in the processes used in reloading.

Because Blount Sporting Equipment Division has no control over individual loading practices or the quality of the firearms in which the resulting ammunition may be used, no responsibility—either expressed or implied—is assumed for the use of these data.

The data contained herein replaces, supersedes and obsoletes all data previously published by Speer, Omark Industries and Blount, Inc.

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Thanks, AJG

NUMBER SPEER TWELVE

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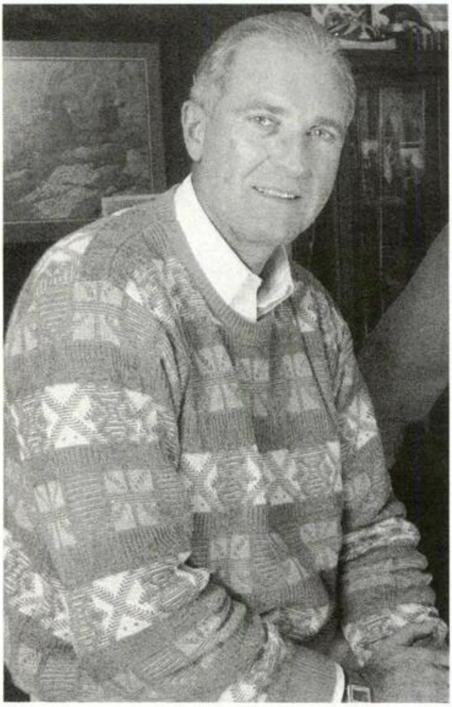
Dedication



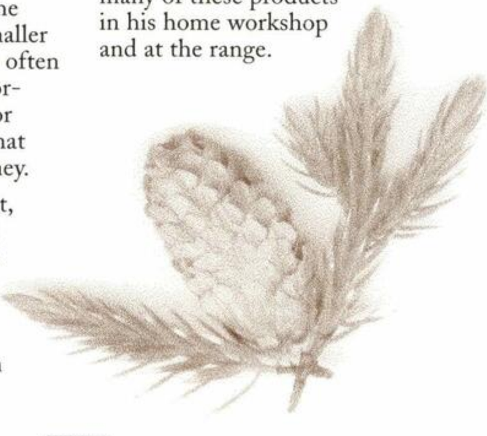
Arlen Chaney

Great companies get that way through teamwork, but every team must have one person who keeps the vision of excellence instilled in the rest of the members. When the companies that make up Blount's Sporting Equipment Division were still family-owned, it was the founders—Vernon and Dick Speer, Fred Huntington, Vern Dale and William Weaver— who were the visionaries. But after several smaller firms join together, the focus is often diluted unless someone steps forward to continue the dream. For Blount Sporting Equipment, that person has been Arlen L. Chaney.

Arlen is a native of Sandpoint, Idaho where kids grew up with plenty of opportunities to learn and enjoy the outdoors. He took his first elk at age twelve, beginning a lifetime of active hunting. After graduating from high school in Kellogg, Idaho, Arlen entered the University of Idaho and graduated with a Business Degree. He was also a Distinguished Military Graduate and entered the Army Ordnance Corps with a regular army commission. He served at Fort Benning, GA, where he completed Infantry Officer School, Airborne School and Ranger School. After serving with the 101st Airborne he worked at Aberdeen Proving Ground and Waterton Arsenal. Arlen left the service to begin a career in private industry after six years of active duty.

In 1965, he joined Cascade Cartridge Company in Lewiston, ID as a Sales Engineer. He sold CCI primers and was deeply involved in bringing Mini-Mag 22 LR ammo to the market. Following Omark's purchase of CCI, he was Sales Manager until 1975 when he was promoted to Director of Marketing. During this time Omark bought both Speer and RCBS to build a solid base of reloading technology.

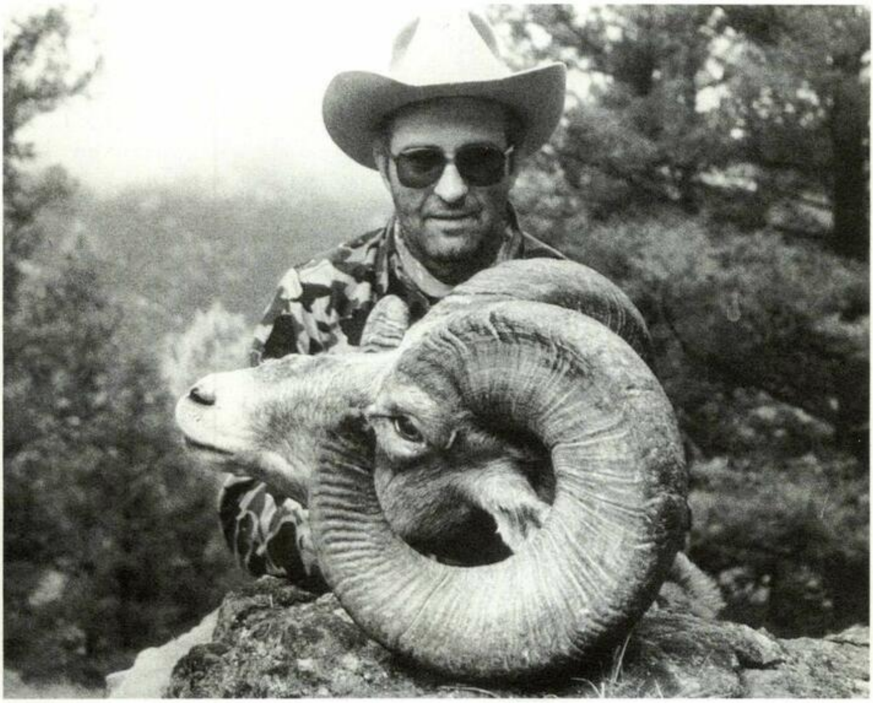
In 1981, Arlen moved up to President of Omark's Sporting Equipment Division and Omark acquired Outers Laboratories and Weaver to complete the family of shooting companies. Many of the new products from all five companies were the direct result of Arlen's vision of quality shooting sports products. He personally evaluated many of these products in his home workshop and at the range.



Working in the shooting industry gives a man opportunities for great hunts and Arlen takes advantage of these whenever his busy schedule permits. He now has an impressive Grand Slam of North American sheep and usually manages to take an elk every year. The fine upland bird hunting around Lewiston hasn't escaped Arlen's attention, and he enjoys trap and skeet shooting at the Lewiston Gun Club.

Arlen has been active in the industry well beyond his duties here at Lewiston. He has served as the Chairman of the Board for the National Shooting Sports Foundation, and a member of the executive committees for both the Wildlife Management Institute and the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI). And when the Sportmen's Team Challenge in Florida rolls around each March, Arlen is there shooting.

In 1993, Arlen retired from Blount after 28 years of service and contributions. His vision and wisdom will help us carry on into the next century. We join our fellow Blount employees in extending Arlen a heart-felt "well done" along with our best wishes for a long and active retirement.



Arlen, taking time out to enjoy a successful sheep hunt.

ACKNOWLEDGEMENTS

Blount Sporting Equipment Division and the staff of the Speer Reloading Manual Number 12 extends our appreciation to the following persons and organizations who have supplied materials and assistance which were invaluable in the production of this manual.

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- *B&I Computer*, Lewiston ID—Jay Thompson
- *Kaltron-Pettibone (VihtaVuori powders)*—Bob Trownsell
- Dr. Ken Howell
- Steve Comus—editor, G*un World* magazine
- *Weatherby, Inc.*—Ken Woytek

FROM THE EDITOR'S DESK...

It was 40 years ago when Vernon and Ray Speer published the first Speer Reloading Manual. It and its successors quickly became among the most valued reference books on reloading. Many cartridges, propellants and bullets have come and gone in the years since Ray and his team spent so many hours in the Speer test tunnel carefully developing loads. Today, Speer's bullets and loading manuals are an integral part of many loading benches.

As I worked on the twelfth edition of the series, I felt a great sense of history. Our test facility—although now greatly enlarged—is the same one that Ray used. Jack O'Conner would drop in to test loads in the Speer tunnel. Dave Andrews, who edited manuals #6 through #11, worked there too, developing test methods still in use today. Any new editor would be impressed with this legacy of expertise.

As you glance through this manual, you'll notice some differences in the format. We've listened to the comments on our earlier books and incorporated a number of improvements in this edition. I extend our thanks to all those shooters who made suggestions. For a run-down of the format changes, please read the introduction to the rifle data section.

In the acknowledgment section, you will find the persons and firms outside Blount who kindly provided assistance in producing this manual. Here I want to offer my personal "thank you" to the people within Blount Sporting Equipment who went the extra mile to help with the project:

- *Warren Cloninger*— Technical Services Ballistic Technician
- *Guy Neill*— Technical Services Coordinator
- *Bruce Young*— Development Engineer
- *Joe Verbanac*— Art Director
- *Debbie Moser*— Technical Services Secretary
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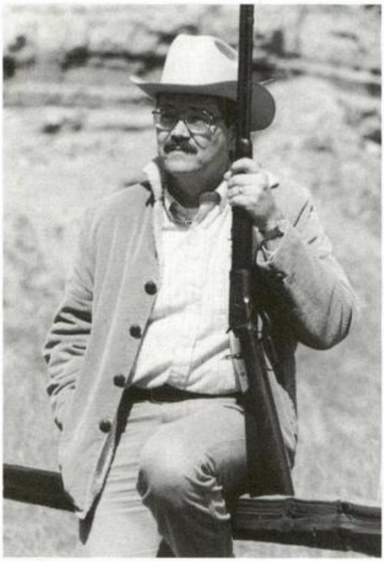
- *Joe Dickenson*— Speer Machinist
- *Art Peters, Jay Postman, Kerry Swett, Bill Keyes and Lee Squires*— RCBS
- *Debbie Deibel*—Merchandising Manager, for her proof-reading

There is one person not directly associated with Blount who deserves special mention here. Lane Pearce of *Shooting Times* graciously offered to do the technical proofing of the text. His generous contributions of his time, talents and sharp editorial skills were invaluable in getting this book to press. Thanks again, Lane. You're a good friend.

Thank you for choosing the new Speer Reloading Manual. We think you will find it one of the most informative books in your shooting library.



Allan Jones, Editor

ABOUT THE CARTRIDGE DRAWINGS

As you look through this manual, you'll notice a brand new set of cartridge drawings. These handsome and detailed illustrations were drawn by Dr. Ken Howell for his new book, *Custom Cartridges*, Volume One. Through special arrangement, Dr. Howell has allowed Speer to reproduce his drawings for this edition of the Speer Reloading Manual. Dr. Howell's book is available at wholesale and retail from Huntington Die Specialties, P.O. Box 991, 601 Oro Dam Boulevard, Oroville, CA 95965, phone (916-534-1210) and at retail directly from the author at 407 Spring Street, Stevensville, MT 59870, phone (406-777-2878).

Volume One of *Custom Cartridges* includes the designing and forming of cartridges for both rifles and handguns. Volume Two, when published, will cover the loading and testing of custom cartridges.

We extend our thanks to Dr. Howell for his kind permission to use them in the Speer Reloading Manual.

Important Cartridge Drawing Copyright Information

All rights to the drawings are reserved by the author. Format, shading, dimension line layout and style, and arrowheads are protected by copyright 1994, by Dr. Kenneth E. Howell. No part of any cartridge drawing in this publication or the source publication may be copied or distributed, transmitted, transcribed, stored in a retrieval system, or translated into any human or computer language, in any form or by any means, electronic, mechanical, magnetic, manual or otherwise, or disclosed to third parties, without the express and specific written permission of the copyright holder, Dr. Kenneth E. Howell.

Minor modifications of the drawings' original font and arrowheads were made by Speer to facilitate file conversion from DOS-CAD to Macintosh format for electronic typesetting. The drawings were reduced from their original scale of 2:1 to 1:1 to fit the page size of this manual.

CHAPTER 1

A HERITAGE OF INNOVATION...

CCI • SPEER • RCBS • OUTERS • WEAVER

It wasn't by accident that five old, family-owned shooting companies came together. The gradual merging of these firms under one banner was planned to draw on each other's strengths and experience, forming a solid base of service and expertise for the sports shooter. Together, CCI, Speer, RCBS, Outers and Weaver are able to offer one of the widest lines of shooting and reloading products in the industry.

SPEER

Component Bullets and Premium Handgun Ammo

Vernon Speer was a man whose life was driven by his inventive nature. He was born in Cedar Falls, Iowa, in 1901. Serving in the U.S. Navy during World War I, he became interested in aviation. At age 21, he designed and built an aircraft engine. To prove its worth, he installed it in a biplane and flight-tested it himself.

Vernon Speer

For ten years, Vernon was a tool foreman for John Deere Company. In 1941, he became chief ground instructor at a flying school in Lincoln, Nebraska. While living there, Vernon began making bullets.

Back then, reloading was not a widely practiced hobby and most components were available only from the major ammunition manufacturers. Traditionally, selection was limited and supplies could not always keep up with demand. Vernon was quick to realize the need to fill a gap in the system. If he could specialize in component bullets, perhaps there was enough interest among shooters to make a small business a reality.

Things were not good for shooters in general in the 1940's. The war effort made most ammunition products almost impossible to find and one of the basic materials, copper, was pouring into the government arsenals at a staggering rate. Faced with an untenable raw material situation, Vernon's clever mind came up with a solution.

In spite of the military demands, one scrap material was abundant. Rifle ranges were covered in spent 22 caliber rimfire cases. Vernon designed and built a machine to iron out the rims and draw the cases to the proper dimensions to function as 22 caliber bullet jackets. The system worked and, by word of mouth, shooters discovered a source for the badly needed components. Soon, he was scrambling to salvage as much rimfire brass as possible.

In 1944, Speer realized his wish to move West. After much searching for the proper climate, business environment and, of course, proximity to good hunting, he came to Lewiston, Idaho. Here he started his bullet-making operation in the basement of an old grocery store. He continued to produce 22 caliber bullets and sold his goods in paper bags. The first two years proved that Vernon's plan was sound—the Speer Bullet Company was on its way.

With the end of the war, the basic material of bullet jackets, gilding metal, was once again available and Speer could expand his line into other calibers. His son, Ray, joined the firm in 1952 to take on the administrative burdens, permitting Vernon to spend more time on research and development. Ray developed the original Speer Reloading Manual in 1954, the first in a long and valued line of reference materials.

During this time, many innovations in bullet design and performance rolled out of the bullet works on Snake River Avenue. One of the most famous is the Speer Hot-Cor® hunting bullet. It has long been the workhorse of the line, and is surpassed in performance only by Speer's Grand Slam® premium bullet. Speer also led the way in developing high-performance handgun bullets for hunting and defense.

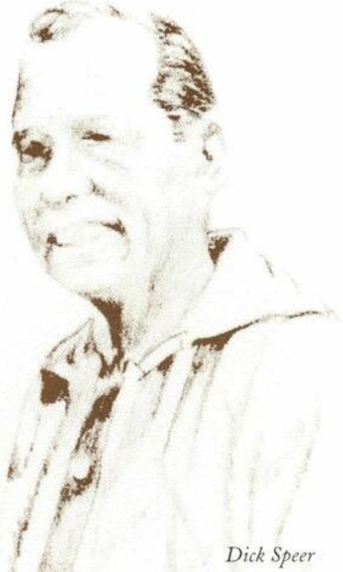
In 1969, Speer decided to put the world's best handgun bullets into loaded ammunition. Thus was born the famous line of Lawman® centerfire handgun ammunition. Vernon also realized the advantages of reusable packaging and invested in injection molding equipment to make plastic boxes for his bullets and ammunition. This technology also opened the door for plastic training ammunition and shot capsules for handgun cartridges. The innovation just doesn't seem to stop.

Speer bullets remained a family owned and operated business until Omark Industries of Portland, Oregon, acquired the company in 1975. After Omark bought Speer, new designs continued to make their way to reloaders' benches. Mag-Tip and Grand Slam rifle bullets are prized for their performance on big game and a new line of premium handgun bullets—Gold Dot—was developed in 1992. For additional information on these and other Speer bullets, see Chapters 3 and 12. Some of Vernon Speer's original employees still work here, carrying on Vernon Speer's vision of the better bullet.

CCI

Centerfire Handgun Ammunition, Rimfire Ammunition and Component Primers

There was another member of the Speer family who, like his brother Vernon, had a remarkable talent for things mechanical. Dick Speer was employed as a machinist at Boeing Aircraft in Seattle. The brothers felt there was another niche in the reloading marketplace that could prove as successful as had Vernon's bullets.



Dick Speer

There were several proprietary or specialty cartridges that were reasonably popular, although handicapped by a reliable supply of brass cases. Major ammunition makers had discontinued the manufacture of exotic rifle loadings like the Newton series, and had not supported semi-custom ammunition like the Weatherby cartridges. Dick quit his job with Boeing and headed to Lewiston to join his brother. In a small room at the Speer bullet plant he began production of these special brass cases using an impact extrusion technique.

The cases were originally sold under the name "Forged from Solid", which was later changed to Speer Cartridge Works. Although the extrusion process was sound, the quality of raw brass stock was poor in those post-war days. Material quality varied so much that few acceptable cases could be made and shipped to customers. In order to build a viable business, Dick Speer decided that there was more future in centerfire primers. Major ammunition factories were reluctant to cut into ammunition sales by providing a steady and generous supply of centerfire primers to reloaders. Like his brother Vernon, Dick found the inattentiveness of the "big" companies created a niche where an entrepreneur could thrive.

In 1951, Dick hired an explosive chemist from Lithuania, Dr. Victor Jasaitis, to develop the various chemicals needed for small arms primers. The first shipments were military primers using the classic FA-70 mixture made for a government contract. Later, non-corrosive primer compounds were developed for sporting applications.

Business was good but some confusion on the part of consumers regarding Speer Cartridges and Speer Bullets led Dick and his partner, Arvid Nelson, to change the name and incorporate as Cascade Cartridge, Inc. The now-famous initials CCI became an integral part of the shooting world. CCI soon outgrew its little area in brother Vernon's plant, so Dick sought a new location to expand his operations. He bought a 17 acre chicken farm next to the Lewiston Gun Club just a mile down Snake River Avenue from Speer Bullets. The farmhouse became the office and warehouse, and production began in a tar-paper chicken coop. Soon, modern buildings were erected and there was room to expand the product line. When the gun club moved a few years later, Dick bought the land for future expansion of his manufacturing facilities.

SPEER
300 WEATHERBY MAG.
SPEER
35 NEWTON

Collectors' Item: Original Speer rifle case.

In 1957, CCI added shotshell primers and, two years later, branched into industrial powerloads for use in powder-actuated tools. Rimfire sporting ammunition was introduced in 1963. CCI Mini-Mag™ ammunition became known as the premium 22 Long Rifle ammunition, noted for its accuracy and power. Dick Speer sold CCI to Omark Industries in 1967. Omark wisely chose to let the development continue and many new products continued to flow from the plant. Stinger® rimfire ammunition put the word "hyper-velocity" into the shooters' lexicon. With a nominal velocity of 1640 feet per second, Stinger was and is the fastest 22 LR ammo in the marketplace. In 1980, CCI introduced one of its most revolutionary products—Blazer® centerfire handgun ammunition. Blazer uses a special aluminum alloy instead of brass in the fabrication of the cartridge cases. Blazer offers economy previously only available in reloaded ammunition, yet is factory-loaded to industry standards. In addition to its acceptance by civilian shooters, Blazer has become the training round of choice for many police officers and has been adopted by agencies at all levels of government.

CCI began a major primer improvement program in 1986. With the entry of progressive reloading presses into the consumer market, CCI saw the need to optimize primer metallurgy and chemistry to stay in the forefront of the reloading market. The results of this extensive test program were seen in late 1989. These state-of-the-art primers feature lower seating forces and greatly improved sensitivity. In addition, the primer cups and anvils were redesigned to provide top-notch feeding in automatic priming systems found in modern, progressive reloading equipment.

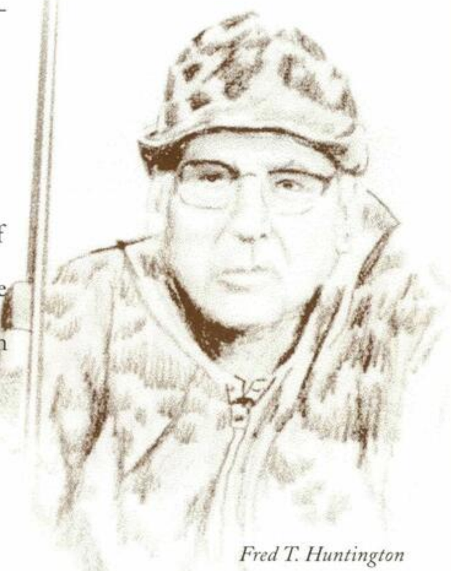
In 1991, a new primer manufacturing facility was opened in Lewiston. This plant gives CCI the latest in explosive chemistry technology. CCI is committed to providing quality primers and ammunition to the reloading fraternity for years to come. Dick Speer wouldn't have it any other way.

RCBS

The Finest Reloading Equipment in the World

There are a remarkable number of similarities among the founders of the five companies that make up the Sporting Equipment Division. In 1943, Fred Huntington, like Vernon Speer, found that good quality reloading components just weren't available from the major ammo factories. Fred started experimenting with handmade die sets that could be used to swage bullets in the home workshop. The first models were made from scrap automobile axles. The precision bullets were usually used for varmint hunting and a popular target out West was the rock chuck, a smaller cousin of the Eastern woodchuck. From this, Fred called his bullet forming die the Rock Chuck Bullet Swage— RCBS for short.

Huntington's first shop was in the back of his father's laundry in Oroville, California. However, there was soon such a demand for his swage dies that he outgrew the laundry and established a business in his garage, later moving to permanent quarters on Oro Dam Boulevard. Soon, the RCBS line was expanded to include dies for cartridge reloading and Fred added presses and other items to create a complete assortment of reloading accessories. The first general-purpose reloading press, the model A, was introduced in 1949 followed by the massive A-2 press in 1954. The A-2 became the standard by which all other reloading presses were judged. It featured Huntington's patented compound leverage system that provided a great mechanical advantage for heavy-duty bullet swaging and case-forming operations. The A-2 is a true classic, and is still eagerly sought by reloaders on the used equipment market.

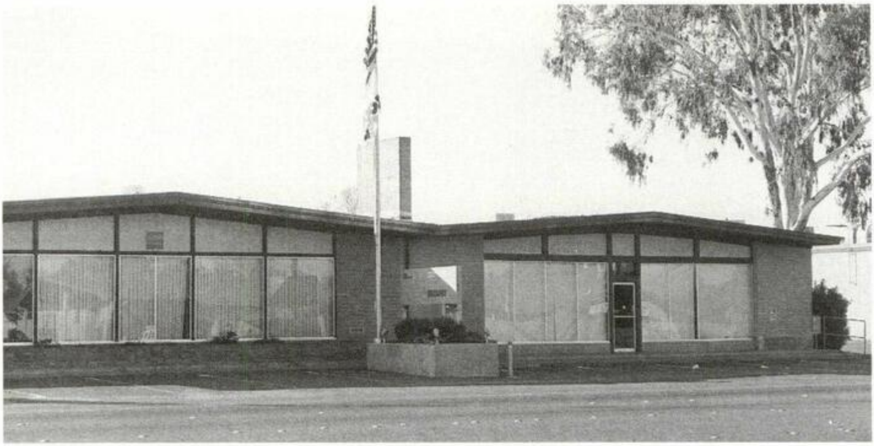


Fred T. Huntington

The A-2 was a fairly expensive press so, in 1958, RCBS introduced the Junior press. Like its big brother, the Junior featured a tough, cast-iron frame, but was scaled down and lacked the compound leverage feature. The lower price of the Junior combined with the RCBS reputation for quality and precision made the new press an instant success. Reloaders who were just getting started could now afford RCBS quality. Today, many reloaders still use their old Junior presses regularly.

In 1967, a new compound leverage press was introduced to offer A-2 features at a more attractive price. The Rock Chucker® quickly became the most popular reloading press in history. Its strength and ease of use have made it the first choice around the world. The Rock Chucker remains today as the cornerstone of the RCBS reloading press line.

Precision reloading presses need precision dies to properly re-



The RCBS manufacturing facility located in Oroville, California.

manufacture ammunition. Fred Huntington developed his reloading die line to the highest standards of fit and finish. One area which other die manufacturers left room for improvement was the bullet seating die. Pre-RCBS dies were often oversized at the critical point where the bullet rests just before seating begins. With little or no support, the bullet could tip as seating pressure was applied causing poor bullet-to-case alignment and thus poor accuracy. Fred designed a seater die with a tight bullet alignment section to keep the bullet from tipping. Today, RCBS offers three lines of rifle dies, two lines of handgun dies plus shotshell dies. The Special Order Die Department has crafted thousands of custom dies for both hobbyists and industry experimenters. In addition to dies and presses, RCBS offers the reloader more accessories than any other reloading manufacturer. All are designed with one goal in mind: to help you do it right.

For the precise engineering that went into all his products, Fred Huntington coined the term "Precisioneered" which, in a word, fully presents the RCBS commitment to serving the reloading community. This term is still the motto for RCBS today.

In 1976, Huntington sold RCBS to Omark Industries to make it the third member of Omark's Sporting Equipment Division. Fred remained on as general manager until his retirement. Since RCBS was purchased, no less than a dozen new or improved press models have been introduced. The latest is AmmoMaster™, a system approach to reloading which allows the beginning reloader to start with a single stage unit and later convert to progressive loading as his skill and ammo needs increase.

Fred Huntington once said, "Why not start out with the equipment that you're going to end up with." Today, over half a century after RCBS started producing reloading equipment, this is still sound advice.

OUTERS

Gun Care from A to Z

Vernon F. Dale was a native of Wisconsin who, by all standards, was the classic rugged individualist. Born in 1900 of Irish descent, Vern settled in the Onalaska area, just outside LaCrosse. After working in a bakery, he bought and operated a garage. At the same time, he managed a pump factory and ran a bus line between Onalaska and LaCrosse.

Vern Dale had a natural prowess for things mechanical. He was a self-taught toolmaker and an avid reader. Like Vernon Speer and Fred Huntington, he was also an active outdoorsman. This led to his developing the specialized gun grease, Gunslick®, which became the first product of the new Outers Laboratories in the 1930's.

During World War II, Vern Dale produced metal parts for military contracts on government-owned screw machines. He won a Navy award for excellence in fulfilling the contract and later bought the equipment from the government. This provided the foundation for expanding Outers into a complete gun care company with the addition of cleaning rods, brushes and other gear needed to keep firearms in top condition. He designed special machines to make bore brushes so that the shank portion was stronger than traditional brushes. His superior technique for manufacturing bronze brushes is still in use at Outers today.

Dale also added other chemicals to complement Gunslick. Gun oil, nitro solvents, gun blue and stock finish kits were soon with Gunslick on dealers' shelves. Vern came up with the idea to put all the cleaning gear for a firearm into a convenient kit, so that a single purchase gave the shooter exactly what he needed to care for his gun. He also was the first in the shooting industry to develop point-of-sale displays so the products could sell themselves.

Later he introduced NRA-approved targets, rimfire bullet traps, clay bird traps for skeet and trap shooting, a line of leather care products, and the Imperial™ line of upscale cleaning products. To round out the line, gun cases and cabinets were also offered.

Vern Dale passed away in 1976 after a productive and busy life, full of contributions to the shooting sports community. In 1980, the Dale family sold Outers Laboratories to Omark Industries and Outers became the fourth firm to join Omark's growing family. Since then, new products have continued to ship from the Onalaska facility. Recent major entries are the revolutionary Foul-Out® electronic bore cleaning system, the excellent American Sporter-2® sporting clays trap, the Varminter® rifle rest, the Pistol Perch® handgun rest, ScoreKeeper™ targets, and Silverline® aluminum gun cases, to mention a few.

Like the other Sporting Equipment Division companies, Outers continues its commitment to the shooting community through innovation and shooting expertise.

The Outers/Weaver manufacturing facility located in Onalaska, Wisconsin.

WEAVER

On Target with High-value Optics and Scope Mounts

In the 1930's, telescopic sights on rifles were not common in North America. Typically, the scopes were of European manufacture and very expensive. When typical American sporting rifles cost between $35 and $70, a top-quality German scope could cost two to three times that amount. In addition, the scopes were heavy, clumsy to adjust and offered minimal eye relief. A heavy European scope on a powerful rifle left its mark just above the eyebrow of many a shooter. Mounting these scopes on American rifles often was a nightmare and some very complicated mounting systems were developed to hold them in place.

William Ralph Weaver (1905-1975) entered the business world in the late 1920's and, like the other founders of the Omark family of companies, found a situation in the shooting sports industry that needed attention. Bill Weaver thought that German scopes were badly over-priced and that, with proper engineering, a quality, affordable rifle scope could be built in America. He started by building a few scopes for himself and friends, but soon found enough demand to justify a full-time business.

Weaver started his scope business in 1930 with the introduction of the compact, 3-power model 3-30 (later known as the model 330). It came with mounts of Weaver's design. In 1933, he moved from his native Kentucky to El Paso, Texas. With an attractive price, Weaver scopes sold so well that the new operation expanded several times. At the peak of business, the firm employed about 600 employees, and Weaver had become the world's largest manufacturer of telescopic sights. One of Weaver's greatest developments was the Micro-Trac® adjustment system. This patented mechanism allows positive, repeatable click adjustment of the reticule for accurate sight corrections.

The product line grew to include scopes for almost every rifle sport. From the low-cost .22 rimfire squirrel rifle to exotic, bench-rest rifles, Weaver had a model to handle any job. During World War II, Weaver furnished the United States military with the well-known M73B1 sniper scope. The "T" model target scopes were prevalent on serious competition rifles around the world. To make scope mounting easier and more reliable, Weaver developed a complete line of simple, sturdy mounts and rings for almost every popular rifle found in North America. The Weaver base and ring system remains one of the most economical and popular mounts today.

Labor problems and competition in the scope market forced Bill Weaver to sell his company to Olin Corporation in 1968. Olin continued the Weaver operation until 1984 when foreign competition made the business unprofitable.

Shortly after the closing, Omark's Sporting Equipment Division—which by now owned CCI, Speer, RCBS, and Outers—bought the Weaver mount-making equipment. Because much of the technology used to manufacture mounts was already in place at the Outers Operation in Onalaska, Omark moved the remaining equipment to Wisconsin where Weaver mounts and rings are still made.

In 1987, Omark announced that it had purchased the Weaver optic patents and the trade name, and introduced the Next Generation Weaver scopes. Next Generation scopes kept the best features of the old Weaver designs, especially Micro-Trac, and added modern improvements such as high-tech multi-coating for optical surfaces, better shock-proofing and greatly improved weather sealing. Each new Weaver scope undergoes stringent water immersion and shock-testing before leaving the factory. In addition to the new line of scopes, Weaver has developed new mounts systems including Converta-Mount™ for shotguns, light economical Pro-View™ and See-Thru mounts, and a revolutionary sight for bow hunters, the BoWeaver®.

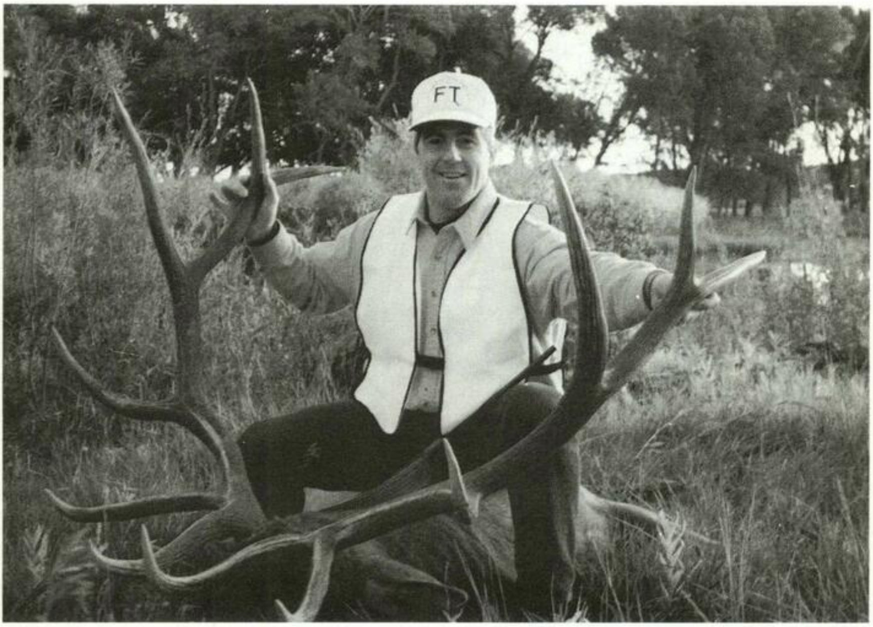
Through the efforts of Omark's Sporting Equipment Division and now Blount, Weaver scopes and mounts are still available to the grandchildren of Bill Weaver's original customers.

Omark and Blount

Omark Industries started as the Oregon Saw Chain Company in Portland. Much of the success of the firm was due to the development of a special chipper tooth for saw chain that kept the cut free of debris and was easy to sharpen. As the business grew, Omark expanded its product line to include powder-actuated tools (PAT) for industrial fastening use. Worried that its PAT business would suffer if the major ammunition manufacturers cut off sales of powerloads to Omark, the company looked for its own source of loads. In 1967, Omark bought Cascade Cartridge, Inc., from Dick Speer. Although Omark was really interested in the powerloads which CCI manufactured, they saw how profitable the sporting ammunition and component primer business could be. Wisely, Omark continued to invest in the sporting side of CCI.

This solid start in the shooting sports field led Omark to eventually acquire Speer, RCBS, Outers and Weaver. Omark maintained three major divisions: The Oregon Saw Chain Division, Hydraulics Material Handling Division that manufactured heavy logging equipment and the Sporting Equipment Division.

Blount, Inc. is a major manufacturing and construction firm headquartered in Montgomery, Alabama. Blount (pronounced to rhyme with "hunt") wanted to branch out into manufacturing to smooth over seasonal variations in the construction business. In 1985 Blount bought Omark Industries because of Omark's solid reputation for quality products, efficient manufacturing and profitability. Blount has given the Sporting Equipment Division the freedom to continue their investment in the future and has provided the financial support needed to sustain the growth. Blount is firmly committed to shooting and will make sure that enthusiasts continue to enjoy quality products.

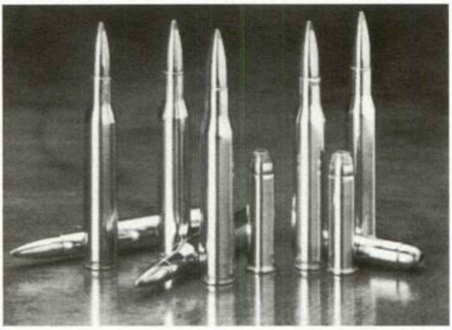


Tom Fruechtel, Sporting Equipment Division President with his 6 x 6 bull which scored a 347. Tom took the elk on the Forbes Trinchera Ranch in Alamosa, Colorado. (270 caliber 150 gr. Grand Slam)

CHAPTER 2

HANDLOADING: A HOBBY FOR A LIFETIME

The terms *handloading* and *reloading* are almost interchangeable. Handloading is the act of assembling loaded ammunition on a non-commercial basis using simple equipment. Reloading is the re-processing or recycling previously fired cartridge cases into loaded ammunition. A fired case requires that several operations be performed to restore it to a condition suitable for firing. As a reloader, you have control over these processes. The act of reloading ammunition can be a very rewarding part of the shooting sports and one that will enable you to shoot more ammo and shoot more often.



"Sight" your ammunition to match your gun.

Most new shooters begin with factory ammunition usually because it's the fastest way to try out that new gun. However, as the shooter becomes more familiar with a gun, eventually he will consider handloading his own ammunition. Let's look at several factors involved in this decision.

Economy

Saving money is usually the first reason to consider handloading. The cost of factory ammunition will eventually cause many shooters to look for a way to reduce costs in order to shoot more. Most written materials on handloading, especially those which are of an introductory nature, point out that reloading gives you more shots per dollar. The costliest component of a cartridge is the brass case that easily accounts for 65 percent of its cost. If your buy and shoot 100 rounds of factory ammunition, you will have 100 empty cases that have a significant retained value. Leaving them on the ground at the range means that you have lost that money. The case can be reused several times before it's no longer suitable for loading. The reloader can use this remaining case life to reduce his cost per shot. If you plan to do even a moderate amount of shooting, the pay-back time for the hardware investment is relatively short.

"The best ammo maker for your rifle is you."

The actual saving per shot depends on the cartridge you plan to reload. Components for a large-capacity rifle case are more costly than those for lead bullet pistol ammo. Here are some general guidelines:

30-06 with 150 grain soft point:

bullet	14.9¢
50.0 grs. of propellant	10.7¢
primer	2.0¢
Total	27.6¢
Cost of factory ammunition	75.0¢
Percent savings	*63%*

38 Special with 148 grain lead wadcutter:

bullet	7.2¢
3.0 grs. of propellant	0.5¢
primer	2.0¢
Total	9.7¢
Cost of factory ammunition	25.2¢
Percent savings	*61%*

All costs based on prevailing retail prices at time of printing

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As you can see, the only component that has the same cost is the primer. In large rifle cases, the propellant is a significant portion of the total cost. The small amount of propellant used in the 38 Special load is almost negligible compared to the other components.

Most reloaders will tell you that they started loading their own ammunition to save money. Once they began, they quickly discovered the second reason.

Custom-tuned Ammunition

When the new handloader takes his reloaded ammunition to the range, he often finds that it shoots better than the factory ammunition he tried the week before. Factory ammunition is great stuff—meeting industry standards and thoroughly tested. In spite of all this, the fact remains that major ammunition factories must design their ammunition to shoot reasonably well in thousands of different rifles or handguns. With the wide variety of makes and action types available, factory ammunition must fit the shortest action and the tightest chamber of the lot.

Careful loading and testing of reloaded ammunition will point the way to the component combination that will shoot best in your firearm. For example, in some calibers, factory ammunition is loaded to the minimum cartridge length so it will operate through the shortest action. If your rifle has a longer action and/or magazine, you can load up to the maximum industry cartridge length or the length your rifle allows and find that accuracy is greatly improved. Likewise, you may find that your rifle performance is enhanced with a certain bullet weight or style. Handloading gives you the flexibility to tune ammunition to your rifle or handgun. A

Charlie Gaustad, RCBS Customer Service, with nice Idaho Muley buck. (6mm, 100 gr. Grand Slam) wise man once said, "The best ammo maker for your rifle is you." This is still sound advice today.

Versatility

Soon after discovering the economy and improved accuracy that reloading offers, the shooter discovers how versatile one firearm can become when the broad assortment of bullet styles is explored. There are styles from varmint bullets to big game bullets in most of the larger rifle calibers. In 30 caliber alone, Speer catalogs 27 different bullets, from 100 to 200 grains. The same rifle that you carry in the game field in the fall can be loaded with light, hollow point bullets to take varmints in the spring. Yet you now have even more control than permitted by bullet selection alone.

Suppose you want to introduce a youngster to your favorite deer rifle but are concerned that recoil may prove too much. The reloader can safely assemble reduced velocity ammunition that will subject the novice shooter to less recoil. Because the rifle has now been "tamed", the novice will be willing to put in much more practice time at the range. As the new shooter's skills and recoil tolerance increase, you can gradually increase the powder charge and/or bullet weight to make a load suitable for the type of shooting you and the new shooter enjoy. Reduced velocity loading data is included in this manual for most popular calibers.

"If you want it done right, do it yourself."

Handloading also lets owners of obsolete firearms continue to shoot even when factory ammunition becomes hard to find. With care, most cartridge cases will last for many firings. Many military rifles in obsolete calibers continue to function with handloaded ammunition, often better than they did when new. While searching for cartridges for these old military models, often only full metal jacket ammunition can be found. The handloader can reload with hunting bullets, greatly extending the usefulness of these old veterans. Even if cases are not readily available, the experienced handloader can convert a common, modern case to function in the old rifles through a process known as case-forming. Often, the reliability of formed brass exceeds that of the original military cases. Case-forming dies for many obsolete cartridges are available through the special order department at RCBS.

Enjoyment

This last benefit of handloading is the hardest to quantify, but it is the area that often means the most to a shooter. Handloading lets you learn all there is to know about your firearm—its likes, dislikes and other factors that give that firearm its own character. The attention to detail and the ability to experiment (within limits, of course) will make you a better, more confident shooter. There is great satisfaction in posting a high score or bagging that big buck with ammo that you have finely tuned to the needs of your firearm. There's a lot of truth in the old saying, "If you want it done right, do it yourself."

As you read on in this manual, you will find all the information needed to safely load quality ammunition. With a little care and common sense, reloading can become a rewarding hobby—one that can be shared with your shooting companions, your children and your grandchildren throughout a lifetime.

SPEER RIFLE BULLETS: THEIR CHARACTERISTICS AND USES

In the years since Vernon Speer first made varmint bullets out of spent 22 rimfire cases, many new styles of bullets have evolved at Speer—from super-accurate match bullets to super-tough hunting bullets heavy enough to take the world's largest and most dangerous game. With so many choices of bullet type and style, the reloader may wonder which bullet to choose for his particular shooting sport. To make the choice easier, we present the following guide to Speer rifle bullets.

Remember that a bullet is intended to efficiently deliver ballistic performance to a target. The choice of bullet depends on the rifle, the cartridge and the target. The varmint hunter requires different ballistic performance than the elk hunter. Speer offers a number of centerfire rifle bullets with distinctly different expansion and penetration characteristics for humanely taking every class of game animal.

SPEER HOT-COR®

Hot-Cor is a unique bullet-making process exclusive to Speer bullets. Vernon Speer wanted to develop a technology that would enhance the terminal performance of his rifle bullets. At the time Speer embarked on this project, few game bullets could be relied upon to retain their integrity. Even today, many bullets break up during expansion, resulting in limited penetration and the potential for lost game. A visit to a game processing business for a look at their collection of recovered bullets will tell you the problem still exists.

Hot-Cor Spitzer

Vernon assessed the situation and found that core-jacket separations rather than jacket failures were the primary cause of losing bullet weight on impact. Conventional hunting bullets are made by inserting a cold, lead alloy core into a jacket. Such cores are normally lubricated to allow the bullet assembly equipment to handle them without stoppages. Even if left unlubricated, a coating of lead oxide begins to form on the bullet cores as soon as they leave the core-forming machine. This coating, be it oxide or lubricant, may allow the core and jacket to slip during expansion. Vernon Speer cross-sectioned expanded bullets of traditional construction and found that the core would often slide forward during expansion, feeding lead into the mushrooming nose. This slippage would leave a void inside the base of the bullet, reducing the amount of core adhering to the jacket and making core-jacket separations possible.

Because oxide and/or lubricant on the core seemed to be the prime suspects in core-jacket separations, Vernon Speer attacked this problem and came up with the idea of pouring a molten core into a jacket. Because the core wasn't formed in a separate operation, no lubricant was needed. By pouring the core, no air was trapped between the core and jacket that could cause oxidation. By eliminating the lubricants and oxides, a more secure core-jacket grip was possible. Thus Hot-Cor bullets were born.

Expansion testing proved Vernon's design work to be right. The new bullets were fired into ballistic media and recovered. Sectioning the expanded bullets revealed that the core did not slip in the jacket during mushrooming. An additional benefit is that more core stays in the jacket, and the frontal area, although adequate for traumatizing tissue, isn't so large as to reduce penetration. The portion of the jacket that peels back stays close to the bullet shank, allowing excellent penetration. In laboratory ballistic test media, retained weight is in the 70 to 75 percent range. However, bullets recovered from game often exceed 85 percent retained weight. All Hot-Cor bullets feature a flat base and internally tapered jackets to insure adequate strength for the task.

The classic application for Hot-Cor is the hunting of game animals that are at the upper end of your rifle's ability. For example, if a big whitetail is considered the largest game you want to shoot with a 257 Roberts, then the 120 grain Hot-Cor bullet is the choice for deep penetration over a wide range of shooting angles. As experienced hunters know, good penetration is critical to successful performance on large game.

Speer Hot-Cor bullets are manufactured in four tip configurations: spitzer, semi-spitzer, flat point and round nose. Spitzers have higher ballistic coefficients for better retained velocity on long shots. Semi-spitzers have a modified nose for medium range shooting and are offered for cartridges where the loaded cartridge length is critical, such as the 375 H&H. Round nose bullets are popular for close-range hunting in heavy cover. They expand reliably even at the low velocities of some of the popular woods cartridges like the 300 Savage. Flat point bullets are designed for safe use in firearms with tubular magazines, such as lever-action rifles.

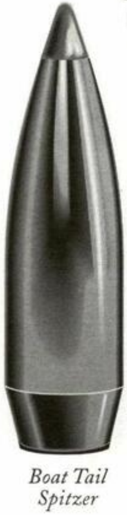
Hot-Cor bullets are manufactured in calibers from 24 (6mm) to 45 for the serious game hunter.

SPEER Boat Tail

Boat tail bullets differ from standard bullets in that the heel is tapered, usually at an angle of 9 to 13 degrees. Boat tail bullets were first used in the United States in 30-06 military ammunition intended for use in machine guns. The idea was to give a longer effective range to the ammunition, although much of this gain was due to the use of a heavier bullet. Now, all major component manufacturers offer the boat tail design. Originally available only to the reloader, this style is now used in factory rifle ammunition also.

Many reloaders are under the impression that the boat tail only contributes to bullet performance once the velocity drops below the speed of sound. All flying objects, including bullets, experience some buffeting when they drop through the "sound barrier", about 1100 feet/second. The tapered heel reduces the effects of this transition on accuracy, but this isn't the only positive effect of the boat tail design.

In fact, the tapered heel has an effect on the bullet's flight over the entire range of velocities. The smaller surface area of the bullet base compared to an equivalent flat base bullet reduces the drag on the bullet. Therefore, a boat tail bullet should retain more velocity resulting in a flatter trajectory. The **ballistic coefficient** (BC) of a bullet is a theoretical measure of a bullet's ability to resist slowing down due to the drag of air flowing around it. The higher the BC, the more easily a bullet slips through the air. The BC for a boat tail bullet is higher than the BC for a flat base bullet with the same point shape and weight. The BC can be plugged into popular computer programs



Boat Tail Spitzer

Table 1 *30-06 loaded with Speer Hot-Cor and Boat Tail bullets. 165 gr. bullets; Muzzle Vel. = 2800 fps.*

Hot-Cor BC of 0.433	100 yds.	200 yds.	300 yds.	500 yds.
Velocity	2586	2381	2186	1824
Energy	2450	2077	1750	1219
Path, inches	+1.90	0.00	-8.00	-47.30

Same caliber and criteria as used above.

Boat Tail BC of 0.477	100 yds.	200 yds.	300 yds.	500 yds.
Velocity	2608	2423	2246	1915
Energy	2491	2149	1848	1343
Path, inches	+1.80	0.00	-7.70	-45.10

such as Speer-RCBS PC Bullet™ to generate drop tables that profile the bullet's flight over a predetermined distance.

In actual practice, most hunters will not notice an advantage in the boat tail for shots under 300 yards. The differences in drop and velocity at these ranges are relatively small, as seen in the example in Table 1 for a 30-06 loaded with 165 grain bullets sighted in for 200 yards.

As the data shows in Table 1, the advantage of the boat tail in drop is minimal. Even at 500 yards, the difference in point of impact is less than two inches. At 300 yards, the boat tail shows an energy advantage of only 100 foot-pounds over the comparable flat base bullet. From this data, it is problematical if the hunter would see a difference in the two bullet's ability to successfully take an animal.

So why choose a boat tail bullet? Many reloaders prefer boat tail bullets because of the ease of bullet seating that the tapered heel offers. But there is more. At Speer, the introduction of the boat tail design gave the opportunity to offer hunters a different terminal effect. Speer boat tail bullets are of slightly lighter construction than their comparable Hot-Cor version and expand somewhat faster. They do not use the Hot-Cor process, so the frontal area of an expanded boat tail bullet is usually larger. Speer boat tail bullets cause greater shock, but penetration is slightly less. They are an excellent choice for lighter species of game animals or for heavy varmints.

In spite of the fact that Speer boat tails are of lighter construction than Hot-Cor, our boat tail is still a substantial bullet. Like other Speer hunting bullets, the jacket is tapered to give greater strength in the shank area, preventing the jacket from rolling back too far. In any boat tail design, rolling the bullet jacket all the way to the tapered heel often allows the jacket to separate from the core. The heavy Speer jacket shank resists separation better than many competitors' boat tail bullets.

Speer boat tail bullets are available in calibers from 22 to 375.

TNT Hollow Point

SPEER TNT™ and other Hollow Point Varmint Bullets

For the ultimate in explosive expansion on varmints, Speer hollow point rifle bullets are hard to beat. Thin jackets and a generous hollow point opening combine to give quick and reliable expansion over a wide range of velocities.

Contrary to popular belief, hollow point rifle bullets seldom give classic "mushroom" expansion at rifle velocities. The bullets are designed to break up soon after impacting the target. Air and fluid trapped in the hollow cavity pries off part of the jacket, causing the bullet to instantly yaw. As soon as the bullet tumbles, its velocity destroys it, creating terrific shock as fragments cause multiple wound tracks.

Varmint bullet penetration is very limited. For this reason, Speer does not recommend hollow point rifle bullets for taking large game. For these animals, the soft point design gives deep penetration and more humane kills. A light, hollow point bullet may only wound a deer-sized animal or cause extensive damage to edible meat.

Velocity Limits for Speer TNT Bullets

Speer TNT varmint bullets are designed to allow explosive bullet expansion in cartridges of modest velocity. As a result of their design, there are upper velocity limits for each bullet.

Caliber	Bullet Wt.	Max. Vel.
.224"	50 grain	3400 fps
.243"	70 grain	3500 fps
.257"	87 grain	3700 fps
.277"	90 grain	3500 fps
.284"	110 grain	3500 fps
.308"	125 grain	3100 fps

Note: If your cartridge is capable of velocities greater than this, we recommend that you use Speer's conventional hollow point bullets.

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On the other hand, this bullet performance is ideal for varmints where quick kills are important and meat damage is not a factor. The classic application is the 22 caliber centerfire cartridges. For cartridges generating velocities up to 3400 feet/sec, the 22 caliber, 50 grain TNT™ hollow point is exceptional. It has a thin, fluted jacket to provide reliable expansion from cartridges like the 222 and 223 Remington cartridges. Because its design still produces expansion at speeds as low as 1800 feet/sec, it is also an excellent choice for the popular 22 caliber centerfire handguns. TNT hollow points are exceptionally accurate, capable of producing 1/2 minute of angle groups in factory varmint rifles. One bench rest shooter posted a 5-shot group of 0.152 inch with the 22 caliber TNT at 100 yards! The 52 grain hollow point can be driven at 220 Swift velocities without problems.

TNT design is also available in 24 caliber (70 grain), 25 caliber (87 grain), 27 caliber (90 grain), 7mm (110 grain), and 30 caliber (125 grain). Conventional hollow point bullets are also available in 24 caliber (75 grain), 25 caliber (100 grain), 27 caliber (100 grain), 7mm (115 grain) and 30 caliber (130 grain). In the larger calibers, hollow points let the reloader use his favorite deer rifle for off-season varminting to keep in practice. In these calibers, hollow points make excellent ammo for use on larger varmints such as coyotes.

SPEER Match Hollow Point Boat Tail

For years, the inherent accuracy of the hollow point design has made these bullets popular with target shooters. Speer makes match bullets in .224 diameter (52 grain), 7mm (145 grain), and 30 caliber (168 and 190 grain). These bullets are suitable for match shooting on paper targets or, in the larger calibers, rifle metallic silhouette shooting.

Precision match shooting must start with precision components. Speer draws match bullet jackets from high-grade gilding metal with constant monitoring of the entire jacket-making process. Final forming is done at low swage pressures to reduce internal stresses. All this care means that Speer match grade bullets will give the kind of accuracy target shooters demand—box after box.

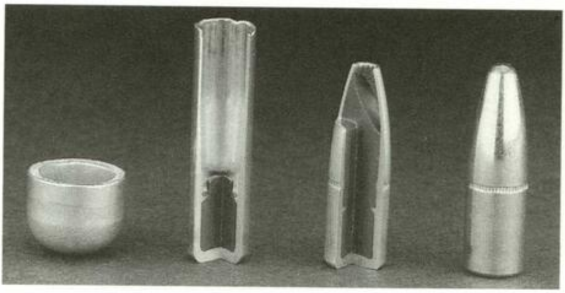
Match hollow point bullets are not recommended for game animals.

Match HP Boat Tail

SPEER Mag Tip®

Speer Mag Tip represents an intermediate step between original Hot-Cor hunting bullets and the premium Grand Slam bullets. Developed in the early 1970's, Mag Tip is still quite popular.

Mag Tip bullets are manufactured using the Hot-Cor process, but the jacket thickness in the critical shank area is roughly 45 percent thicker than the same area in



Grand Slam bullet manufacturing/construction.

the equivalent Hot-Cor bullet. This added material gives Mag-Tip greater strength for high-velocity applications. Mag Tip also features internal fluting at the jacket opening for reliable initial expansion at lower velocities. These features combine to make Mag Tip an excellent choice over a wide velocity range. Mag Tip also has a protected point—the jacket is as long as the core. This feature is useful in bolt action rifles that show a tendency to batter the bullet point in the magazine. Such battering is more prevalent in heavy calibers, but can occur in light calibers depending on the design of the magazine and the weight of the rifle.

These design features of Mag Tip give it a very wide range of usefulness. Every bullet operates in a "velocity window". There is a lower velocity at which the bullet can no longer expand, and there is an upper velocity beyond which bullet break-up is possible. Mag Tip's fluted jacket and flat tip provide better expansion at velocities lower than many spitzers, yet the heavy jacket shank allows very high velocities before bullet break-up occurs. In 30 caliber, Mag Tips are effective in modest velocity cartridges like the 300 Savage, yet have the strength to hold up when driven at velocities possible in the high-performance 300 Magnum cartridges.

Mag Tip bullets are available in 7mm and 30 caliber. The 7mm's are 160 and 175 grains, and the 30 calibers are 150 and 180 grains. Mag Tips use the same loading data as other Speer bullets of the same caliber and weight.

SPEER Grand Slam®

The flagship of the Speer bullet line, Grand Slam incorporates a number of high-tech features to ensure top-notch performance on large game animals. Like Mag Tip, Grand Slam has a jacket with a heavy shank tapering to a fluted mouth. That's where the similarity ends though.

Mag-Tip Soft Point

In Grand Slam, two different core alloys are used. The rear core is formed from a hard five percent antimony-lead alloy. After seating, this hard rear core is locked into place by a ring of jacket material that is sheared down over the lead. This process leaves a button of rear core projecting above the lock ring. Then a front core of softer, one and a half percent antimony-lead alloy is poured into the jacket using the Hot-Cor technique. The front core partially melts the button of the rear core material for a firm "adhesion" grip.

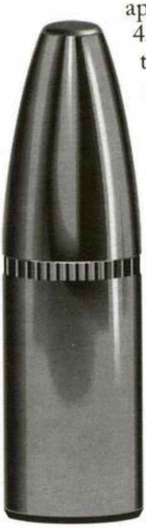
Grand Slam Soft Point

The result is a premium game bullet that retains its rear core plus a portion of the front core for higher retained weight and deeper penetration. Retained weight is usually higher than seen with "partition" type bullets. Bullets returned to us by hunters typically retain around 85 percent of their original weight. All Grand Slam bullets have a crimping cannelure for secure seating in rifles producing heavy recoil. Grand Slam bullets in 24 and 25 caliber have a single-alloy core. The jacket walls in the shank are so thick relative to the diameter that the bullet is very tough even without the two-piece core.

In choosing a premium game bullet, the experienced hunter expects to pay a premium price. However, compared to the high cost of that "once-in-a-lifetime" hunt, the cost of premium bullets becomes negligible. Hunters who demand the pinnacle of performance are increasingly turning to Speer Grand Slam for both the penetration and retained weight needed to insure a successful hunt. Grand Slam bullets are available in diameters from .243 to .375 for all species of North American game. Many head of African plains game have also been taken with Grand Slams.

African Grand Slam Soft Points

When the going gets tough, you need the toughest soft point bullet going—Speer's African Grand Slam (AGS) soft point. Starting with classic Grand Slam design principles, Speer engineers developed a new jacket technology to toughen the bullet for dangerous game. Introduced in 1990, AGS soft points use the principle of retained length to maximize penetration. In designing a bullet that retains at least 60 percent of its original length after expansion, Speer has reached a new level of bullet performance.



African Grand Slam Soft Point

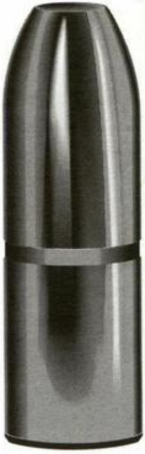
AGS soft points start with a heavy cup machined from a solid bar of gilding metal. The jacket is so thick that it accounts for almost half the total bullet weight; finished jackets have shank thicknesses up to 0.125 inch, easily twice that found in competitive products. Speer's patented Multi-Lok™ feature produces internal serrations in the jacket shank. The cups are then partially drawn, giving the necessary ductility to the forward portion of the jacket, yet leaving the shank portion rigid. A lead core poured into the jacket using the Hot-Cor process flows into the Multi-Lok serrations, firmly anchoring the core in the jacket.

Final forming gives the shape appropriate to the cartridge—the 458 caliber is a round nose and the 416 is a semi-spitzer. Speer's development testing heaped abuse on these bullets never found in the field and they passed with flying colors. One of the toughest conditions a soft point hunting bullet will encounter is hitting bone—say the point of the shoulder—just as it enters the animal. Even then, the African Grand Slam bullet holds together for excellent penetration.

African Grand Slam soft points are available in a 400 grain version for the 416 caliber rifles, and a 500 grain version for 458 caliber rifles.

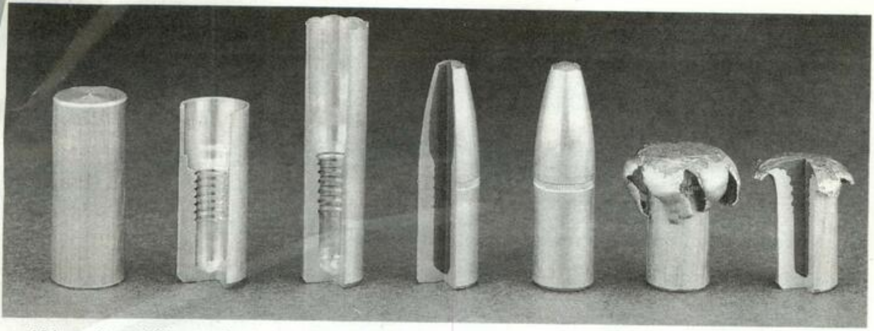
African Grand Slam Tungsten Solids

Solid hunting bullets are designed to show little or no deformation on impact, relying instead on tremendous penetration to break the skeletal structure of the heaviest game. Although seldom needed on the North American continent, solids are the bullets of choice among experienced African guides and hunters. When the game is elephant, rhino or Cape buffalo, the solid is often the only bullet that can be relied upon to anchor the animal. Properly constructed solids must penetrate deeply in a straight line, and remain almost undeformed if they are to work as intended.



African Grand Slam Tungsten Solid

In 1990, after consulting

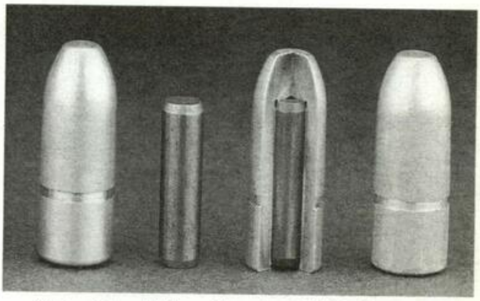


African Grand Slam, soft point bullet manufacturing/construction.

with professional African hunters, Speer introduced the ultimate solid—the AGS Tungsten bullet. Like the AGS soft points, Speer solids start with a solid bar of gilding metal that is precision turned to final external shape. A hole is machined in the rear of the bullet to accept the core material. The core is a solid dowel of tungsten carbide, one of the most rigid and dense materials available for industrial applications. The core is inserted into the jacket and firmly crimped into place to prevent separation.

African Grand Slam Solids feature a broad, flat point design that was fine-tuned with sophisticated aeroballistics software used in the development of heavy artillery projectiles. The goal of the research was to determine the proper combination of shape, materials and material distribution to produce maximum stability both in air and tissue. The resulting African Grand Slam Solid is an outstanding projectile that meets or exceeds the demands of the professional hunter.

Because of the dense tungsten core, African Grand Slam Solids are very compact for their weight. Solid bullets from other manufacturers contain no high-density materials and, as a result, have abnormally long bearing surfaces. Speer's solid is nearly a quarter inch shorter than homogeneous alloy bullets of the same weight. The compact and tough Speer African Grand Slam Solid allows full-power reloading of cartridges where limited case capacity precludes loading to full factory energy if overly long bullets are used. In fact, maximum loads developed in the Speer lab with the AGS solid in the 458 Winchester exceed energies of factory ammunition by 600 foot-pounds, yet operate well within industry pressure guidelines.



African Grand Slam, Tungsten Solid bullet manufacturing/construction.

African Grand Slam Tungsten solids are available in four calibers: 338 (275 grain), 375 (300 grain), 416 (400 grain) and 458 (500 grain).

SPEER Special Application Bullets

Speer's commitment to the reloading community means that there will always be bullets to fit

22, 55 gr.
Full Metal
Jacketed Boat
Tail w/Cann.

22, 62 gr.
Full Metal
Jacketed Boat
Tail w/Cann.

those special needs that do not fall into one of the categories discussed above. For reloaders duplicating military ammunition performance or who need non-deforming bullets for taking fur-bearing game, Speer offers several full metal jacket bullets. In 22 caliber there is a 55 grain boat tail (M193 equivalent) and a 62 grain boat tail (M855 equivalent). In 30 caliber (.308" diameter) Speer offers a 110 grain FMJ for the 30 Carbine cartridge and a 150 grain FMJ BT (M80 equivalent) for the 30-06 and the 7.62mm NATO (308 Winchester). For shooters reloading the 7.62x39mm cartridge, there is a 123 grain FMJ in .311" diameter. If you're into long-range target shooting with the massive 50 caliber BMG cartridge, Speer offers a 647 grain FMJ BT (M33 equivalent).

218 Bee Flat Soft Point with Cannelure

25-20 Winchester Flat SP with Cannelure

32-20 Jacketed Hollow Point

As the popularity of some of the old lever action cartridges increased, Speer supported their comeback with new bullets designed specifically for those rifles. For the 218 Bee cartridge, there's a 46 grain flat point. Fans of the 25-20 cartridge now have a 75 grain Hot-Cor flat point, and there is a .312" diamete 100 grain jacketed hollow point designed for the popular 32-20 cartridge. All three bullets are cannelured in the proper location for smooth feeding in lever action rifles and feature flat points so they can be safely used in tubular magazines.

To add months to the shooting season for 30 caliber reloaders, Speer has two light bullets for off-season practice and varmint hunting. The 100 grain Plinker® was developed as a low-cost practice bullet for all 30 caliber rifles. Its half-jacket design makes sure that the lead core doesn't touch the bore, and the generous exposed lead point means rapid and complete expansion at rifle velocities. The 110 grain Varminter® is a slightly heavier version of the Plinker, with less exposed lead and a large hollow point. Both bullets are excellent for reduced-recoil loading useful in training new centerfire shooters.

Commitment. Skill. Know-how.

As you can see, Speer is committed to the serious hunter and shooter. Continuing research, development and testing has generated a line of rifle bullets that can handle the entire range of game animals, from prairie dogs to pachyderms! Nearly fifty years of experience goes into every bullet, helping the reloader make those great shots.

MODERN CARTRIDGES & THEIR COMPONENTS

Modern rifle and handgun cartridges, known as metallic cartridges, have four components—the cartridge case, the primer, the propellant and the bullet. Knowing the role of each of these will help the novice reloader understand the entire loading process and why each operation is important.

Reloading components are the ingredients for countless possibilities and years of enjoyment.

THE CARTRIDGE CASE

The most costly and critical component of metallic cartridges is the cartridge case. In addition to being the "envelope" that holds all the other components, the case acts as a precision seal to insure that the high-pressure, expanding gases remain in the firearm (and away from the shooter!) to efficiently push the bullet out of the barrel.

All current cartridge cases suitable for reloading are made of brass, a metal alloy containing 70% copper and 30% zinc. Foreign military rifle and pistol ammunition is often loaded in steel cases, which are not suitable for reloading. Some steel cases are stained or lacquered to a darker color and may not be readily apparent as being steel. If you purchase surplus fired brass, run a strong magnet through the cases to sort out any steel cases. The recovered steel cases should be permanently deformed to prevent accidental reuse.

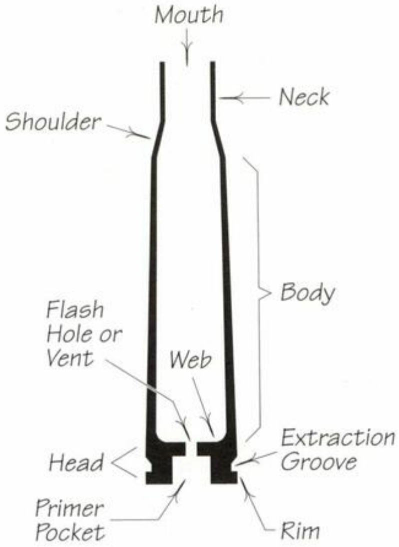
CCI manufactures Blazer® centerfire handgun ammunition using aluminum cases. The special aluminum alloy is as strong as brass at the pressure levels for which Blazer is intended. However, Blazer cases are not reloadable. They use a Berdan priming system and primers are not readily available in this style. Blazer was designed to make factory ammunition more affordable to the millions of shooters who choose not to reload. Speer Lawman™ and Gold Dot™ cartridge cases are conventional brass construction and are suitable for reloading.

Cartridge cases fall into several categories by body shape and head configuration. Regardless of shape or application, all cartridge cases have some feature that consistently positions the case in the chamber. The linear, or front-to-rear, play of a cartridge in the chamber with the action closed is called *headspace*. Headspace dimensions for factory cartridges are established by the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI). Headspace must be maintained when handloading ammunition. However, the case configuration determines how much effect the handloader has on headspace.

Case Types

Body shapes include: bottleneck, straight and straight-tapered. The majority of modern rifle cartridges are bottlenecked (Examples are the 30-06 and the 223 Remington). In most calibers, the shoulder of a bottlenecked cartridge is used to control headspace. Straight and straight-tapered cases commonly include older designs like the 45-70, although there are few modern rifle cartridges that have straight cases. There are a few modern cartridges that use the straight tapered case. The 30 Carbine and 9mm Luger cartridges are examples of this case type.

Head types include rimmed, semi-rimmed, rimless, belted and rebated rim. Rimmed cases were the rule for many years following the introduction of modern, fixed ammunition. Rimmed cases have a protruding flange at the head to limit the forward motion of the cartridge in the chamber; thus headspace is controlled by the rim thickness. Common examples of rimmed cases are the 30-30 Winchester and the 22 Hornet.

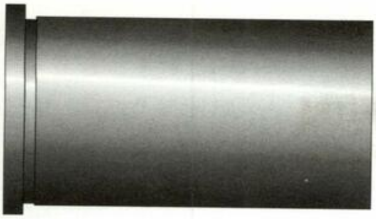


Semi-rimmed cases are intended to headspace on the shoulder since most examples are bottleneck designs. The only recent rifle cartridge to use the semi-rim design is the 225 Winchester. In this case, the semi-rim is the diameter of a 30-06 rim while the case body is somewhat smaller. This allows gun makers to build 225 rifles on standard actions. Several pistol cartridges are semi-rimmed (25 Auto, 32 Auto and 38 Super Auto).

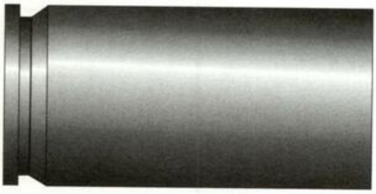
In modern rifle cartridges, the rimless design is the most common. There is in fact a rim but it is the same diameter as the case head so it does not project beyond the body of the case. Lack of a protruding rim allows the cartridges to stack easily in box-type magazines. With a few exceptions, these cartridges are bottle-necked, so the headspace is controlled by the position of the case shoulder. To facilitate extraction, the case is undercut just ahead

Belted Case

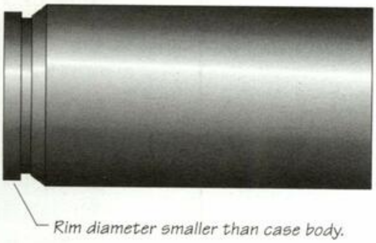
Rimmed Case



Rimless Case



Rebated Rim Case



of the rim, forming an *extraction cannelure.* The groove allows the firearm's extractor to engage and pull a fired case from the chamber.

Belted cases are a variant of the rimless case. These cases have a raised belt just ahead of the extraction cannelure. This feature was originally developed by H&H for the 400/375 H&H Belted Nitro Express. This cartridge, although classed as a bottleneck design, has a strongly tapered case with a low-angle shoulder that can have difficulty resisting the firing pin blow. To provide for positive headspace control the cartridge designers added a raised belt to the case that mates with a corresponding recess in the rifle's chamber.

Most modern cartridges bearing the "Magnum" designation have a similar belt. However, this feature is not necessary in cases with a more prominent shoulder. Theory says that the case should headspace on the belt; however, accuracy and case life are improved if the reloader sets the sizing die so the case can headspace on the shoulder. Belts on most modern "Magnums" are primarily cosmetic. They add little to the strength of the case, and are not necessary for proper headspace control, except in the H&H cartridges and the 458 Winchester Magnum. However, it seems that, to be popular, any "Magnum" cartridge needs a belt.

The rebated rim case is seldom seen in modern cartridges. In these cases, the rim is smaller than the case body, allowing additional powder capacity but provides a standard diameter to fit existing bolt faces. The most recent rifle cartridge of this type is the 284 Winchester. In handgun ammunition, both the 41 and 50 Action Express cartridges have rebated rims.

The Case as a Safety Feature

As stated earlier, the function of the case is to contain the primer, powder and projectile in one unit for convenient handling, and seal the barrel breech during firing. This second function is important for efficient performance and safety. The case must be strong yet flexible enough to seal off the chamber so hot gases are kept away from the shooter. The brass must also be resilient so that, after firing, the case will spring away from the chamber walls to allow easy extraction.

In rifle applications, brass has the best combination of properties to accomplish this. Reloaders should always remember that the modern rifle is capable of handling greater pressures than the brass case. The steel alloys in modern rifles may have yield strengths ranging up to 160,000 pounds per square inch (psi) or higher. The best brass case will hold less than half that pressure. Thus, the case becomes the limiting factor in the overall gun system. By following lab-tested reloading data from this manual or others, you will remain safely within the capabilities of modern brass cases.

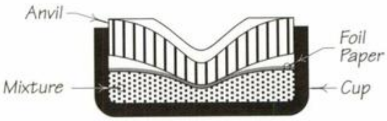
The handloader needs to be aware of the function of the case and use reasonable care in processing cases when reloading. With quality loading equipment and proper handling, the case will give numerous firings before it must be discarded.

PRIMERS

Primers provide the "spark" needed to set a cartridge in motion. The smallest component of the cartridge, primers are often given little consideration beyond the fact that they need to be present.

In spite of their simple appearance, modern primers are complex devices which represent decades of evolution and development. In addition to igniting the propellant, the primer produces a small initial pressure to support the burning propellant, and seals the rear of the case to prevent high-pressure gases from escaping.

Primer Construction



All primers contain a small amount of a primary explosive, the *initiator*, which will detonate when struck by the firing pin. In addition to the explosive, a *fuel* projects burning particles into the largest cases. To raise the temperature of the reaction an oxygen source, the *oxidizer*, is present. Most modern priming compounds include traces of powdered aluminum to supplement the fuel. Primer compounds also contain sensitizers to control the energy required to activate the primer and binders to hold the primer mix together during shipping and handling.

Primer Evolution

The explosive mix in small arms primers was originally *mercury fulminate*. This compound was developed during the muzzleloading period and functioned fine in these firearms. Only when copper and brass cartridge cases were introduced did a problem develop. The vaporized mercury released from the primer attacked the brass and soon caused the case to become brittle. This brittle condition rendered the cases unsuitable for reloading.

Later, the priming compound was changed to *potassium chlorate*. This avoided damage to cartridge brass, and proved to be a very stable and reliable priming formula. The only negative feature was that, after firing, the residue contained chemicals similar to common table salt that could cause rust if the gun barrel was not cleaned promptly with soap and hot water. Because of this characteristic, chlorate primers are referred to as corrosive.

To eliminate the need for immediate cleaning, a new priming initiator was developed in the late 1920's. *Lead styphnate* blended with non-corrosive fuels and oxidizers made a clean, stable priming compound that met all requirements. Virtually all U.S. commercial ammunition and component primers have been assembled using lead styphnate for over 60 years. However, the U.S. military did not abandon chlorate primers until the 1950's. Lead styphnate primers are referred to as non-corrosive and non-mercuric.

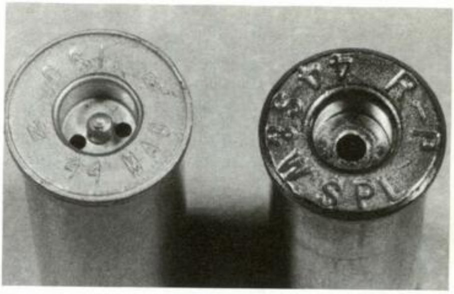
Because of concerns about airborne lead in poorly ventilated indoor ranges, primers have appeared recently which contain no lead compounds or other toxic metals. CCI was the first U.S. primer manufacturer to develop lead-free primers. To date, these primers have been available only in loaded ammunition. Their unique chemical characteristics require extra operations in loading, and they are suitable only with certain propellant types. It will be some time before lead-free primers are developed to the point that they can be used by hobby reloaders.

Berdan vs. Boxer Primers

Rifle and pistol primers for cartridge ammunition have been manufactured using two different configurations of the metal parts. An American ordnance officer, Hiram Berdan, developed a cartridge primer that was a soft metal cup containing primer mix. To provide the support needed to compress the primer mix for firing, a metal post—the *anvil*—was made as an integral part of the cartridge case, located in the center of the primer pocket. Two small flash holes on either side of the anvil allowed the flame from the primer to pass into the main propellant charge. Because the primer is a separate component, it is theoretically possible to remove the spent primer from the case and insert a new one to allow reloading. However, extracting the old primer is not an easy task and damage to the case often occurs during the decapping operation if not carefully performed.

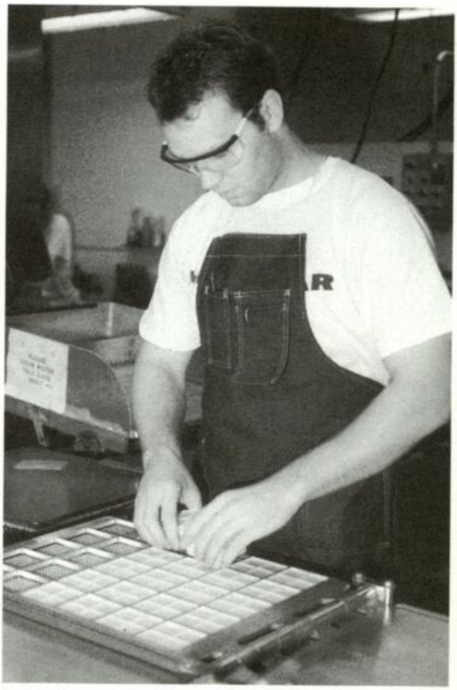
At about the same time that Berdan was developing his priming system, a British ordnance officer, Edward Boxer, was working on a slightly different approach. In the Boxer system, the anvil is not part of the cartridge case but is placed inside the primer itself. Because there was no longer an anvil in the center of the primer pocket, Boxer put a single centered flash hole in its place. This minor change had a big impact on the ability to reload the fired case. The spent primer could easily be removed with a small punch with little chance of harming the case.

As things turned out, the American Berdan system was adopted almost everywhere but the United States. Fortunately, the U.S. ammo industry picked up the English Boxer system and, as a result, the wealth of easily reloadable cases in America made this country the cradle of reloading technology. In the last two decades, many foreign cartridge manufacturers have changed to the Boxer system for priming commercial cases.



Berdan (left), and Boxer (right) primer pockets.

Because a supply of mixed spent cases may contain some foreign Berdan cases, the wise reloader will inspect his brass supply before decapping to insure all the cases are reloadable. Berdan cases can be identified by shining a penlight into the case mouth and looking at the bottom of the case. Two small holes that are off-center indicate that the case is Berdan primed and should be discarded. Reloading of Berdan-primed cases is possible but requires special equipment. Berdan primers



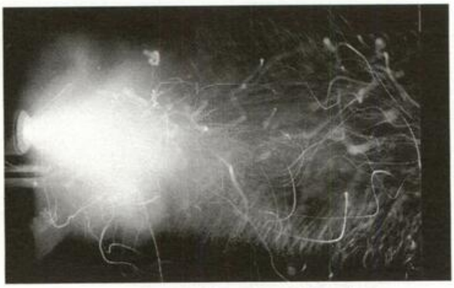
Robert Berger, CCI/Speer Primers employee, positions plastic trays to receive finished primers.

are also difficult to find in this country, and often differ from standard U.S. primer dimensions.

In this country, there are two diameters for primers: .175" and .210". In each size, separate primers for rifle and handgun applications are manufactured. Rifle primers must be able to ignite large charges of propellant and withstand higher pressures than pistol primers. To accomplish this, rifle primers are assembled in thicker cups and have more priming compound. Handguns generally have lighter firing pin forces than rifles and, for this reason, pistol primer cups are thinner to provide proper sensitivity. Except where noted in this manual, it is not recommended that rifle primers be used in handgun cartridges, or vice versa.

CCI Magnum Primers

With certain combinations of cartridges and propellants, a standard primer may not have enough power to reliably ignite the powder charge. For these special applications, CCI manufactures "Magnum" primers. The priming compound in magnum primers is formulated to produce a longer, hotter flame to insure proper ignition. As general guidelines, magnum rifle primers are used:



This photo shows the intensity of the primer detonation which is required to effectively ignite the powder.

- *with spherical or ball-type propellants (some exceptions exist).*
- *when loading large capacity "magnum" cases.*
- *when the cartridge may be fired at temperatures below 20° F.*

Magnum pistol primers are useful when loading large charges of slow-burning ball propellants such as Winchester 296 or H110. In developing loads for this manual, our technicians noted those where magnum primers were used. They are indicated in the data pages by an asterisk (*) next to the powder type. CCI Magnum primers are designated by the number "5" in the middle position of the primer number. For example, a standard rifle primer is a #200; the Magnum version is a #250.

Magnum primers should only be used when recommended by the loading data.

CCI Bench Rest Primers

For critical accuracy requirements, CCI developed the BR-2 and BR-4 Benchrest primers. The BR-2 is a large rifle primer, and the BR-4 is a small rifle primer. CCI BENCHREST PRIMERS ARE BALLISTICALLY EQUIVALENT TO THE CCI 200 AND 400, RESPECTIVELY, AND USE THE SAME RELOADING DATA. The difference is in the materials and assembly. Benchrest cups and anvils are selected for exceptional uniformity. During the assembly operation, the charger (the operator who meters the primer mix into the cup) is chosen from the most experienced workers. The charger who makes CCI Benchrest primers must have demonstrated a performance record of consistent charging technique when making other primer products. The BR line runs at a slower pace to provide time for extra inspection.

This care and uniformity means each primer fires just like the one before, and the one after. In small-capacity cases, significant accuracy improvement is often achieved because of the consistent flame characteristics and gas volume produced by these carefully crafted primers.

Misfires

The most common cause of misfires in reloaded ammunition is the failure of the reloader to fully seat the primer in the case. For proper function and sensitivity, the legs of the anvil must be in firm contact with the bottom of the primer pocket. CCI primers are designed to give optimum sensitivity when seated so that the primer is 0.003" to 0.005" below the level of the case head. In this condition, the anvil is properly supported and the ideal thickness of primer mix between the anvil and the cup is established.

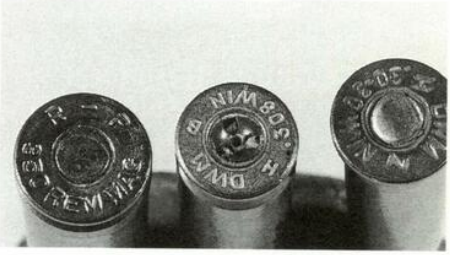
When a primer is not fully seated, some of the force of the firing pin must be used to drive the primer deeper into the pocket. CCI lab tests have shown that if primers are not fully seated, more than 50% greater energy may be required to fire them. Many firearms, especially revolvers, do not have this much reserve energy in their ignition systems. Shooters often attempt to strike a misfired cartridge a second time. Because the first blow usually shatters the priming pellet and upsets the relationship between the various primer parts, the shooter shouldn't be surprised if the cartridge will not fire on the second try.

Misfires can also be caused by excessive headspace. When excessive headspace is present, the cartridge is too far forward in the chamber and the firing pin can't make solid contact. Excessive headspace can be created in rimless bottleneck cartridges by improper resizing that pushes the shoulder too far to the rear. In rimless cartridges which headspace on the case mouth (like the 45 Auto or 30 Carbine), excessively short cases can produce the same effect. Excessively light firing pin springs, off-center hits, and oil contamination can also cause misfires. Very dirty firearms can misfire because excessive powder residue cushions the impact of the firing pin. In revolvers, a type of wear called *endshake* can cause the cylinder to have excessive front-to-rear play. This condition results in excessive headspace, and the primer receives a light hit.

CCI's laboratory investigates reports of misfires in reloaded ammunition. In almost every case, the problem cannot be attributed to the primer. The causes almost always involve a reloading error or a mechanical problem with the firearm.

Slam-fires

A slam-fire is the discharging of a cartridge in a firearm by the closing of the bolt without a pull of the trigger. In most cases this is a phenomenon associated with military-style semi-automatic rifles and handloaded ammunition. The slam-fire can be caused by a high primer or by a heavy, unsprung firing pin. High primers contribute to slam-fires because the closing bolt drives the high primer cup against its anvil. All handloads must be checked for high primers; this caution is even more important when shooting military-style semi-auto rifles.



Primer seating defects can result in misfires.

Slam-fires have been reported even when primers were properly seated. Many semi-auto service rifles have no firing pin spring and the firing pin itself is quite heavy. The inertia of the firing pin may cause it to snap forward as the bolt stops, firing the cartridge. If the bolt is not yet fully locked, the result can be a ruptured case with the potential for gun damage and injury to the shooter. Military primers are less sensitive than commercial primers to minimize this hazard.

In 1994, CCI introduced No. 34 and No. 41 primers for military semi-auto rifles. The No. 34 primer is ballistically equivalent to the CCI 250 Magnum primer, and the No. 41 is equivalent to the CCI 450 Magnum primer. Any load showing a CCI 250 or 450 primer can be primed with the No. 34 and No. 41 primer respectively. No. 34 primers are recommended for reloading 7.62mm NATO, 30-06 and 7.62x39 ammo for military semi-auto firearms. The No. 41 primers are recommended for 5.56mm NATO and 30 Carbine.

No. 34 and No. 41 primers feature mil-spec sensitivity to minimize slam-fires. However, no primer can provide 100% protection against slam-fires if the loader doesn't seat the primers deeply enough, or the rifle has a headspace problem or an out-of-spec firing pin.

For an excellent discussion of slam-fires and their solutions, pick up a copy of *The U.S. 30 Caliber Gas-Operated Service Rifles: A Shop Manual* by Jerry Kuhnhausen, published by VSP Publications, McCall, ID.

Primer Storage and Shelf Life

Our technical staff receives a number of calls each year from reloaders who ask how long primers will last. Shelf life is directly dependent on storage conditions. With proper storage, primers should stay in first-rate condition for decades. Ideally, primers should be stored in a cool, dry environment free from wide temperature variation. Dry storage at temperatures up to 100°F should not significantly affect performance. However, high humidity, especially combined with large temperature swings, can degrade primers. Avoid storing primers in a garage or outbuilding without climate control. Be sure to store primers in accordance with local regulations, and leave the primers in their original packaging until they are needed.

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Please read the section on primers in Chapter 6, "Safety in Reloading".

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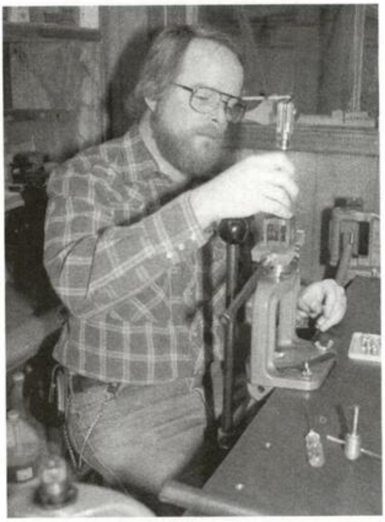
BULLETS

During the infancy of firearms, the first projectiles used were very likely round rocks picked off the ground. Later, iron shot was used in cannon but early small arms shooters soon discovered a naturally occurring mineral—galena—that could be processed with primitive smelting equipment to yield metallic lead. Because lead is very dense, soft and has a low melting point, it is easily worked by remelting or hammering. The earliest lead balls were probably pounded or rolled into shape. Iron moulds for casting bullets from molten lead made the process more uniform.

Lead proved to be an excellent material for bullets. Because of its high density, a lead bullet is heavier than an iron bullet of the same caliber, and retains its velocity better. Lead round balls fired from smooth bores were the standard of the arms industry until the middle of the 19th century. Developers wanted to fire even heavier bullets without making the firearm larger. To accomplish this, the projectile shape was changed from round to conical, allowing doubling or tripling the weight without increasing bullet diameter. However, it was immediately obvious that the conical projectiles were not stable in flight when fired from a smooth bore. Soon after exiting the barrel, the bullet would begin to tumble and loose accuracy and velocity at an



Brett Olin, Engineering Technician, swaging prototype bullets.

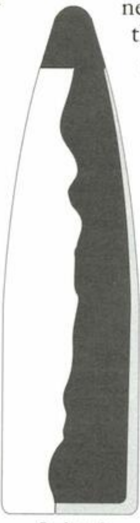
unacceptable rate.

The solution to this problem was to spin-stabilize the bullet. A bullet rotating about its central axis at high speed tends to stay pointed in the direction it started. This is called *gyroscopic stability*. To move the axis of a rotating object from its original orientation requires significant force.

You can see this in a simple experiment. Remove a wheel from a small bicycle and hold it by the ends of the axle. Have a helper spin the wheel rapidly, and then try to move the spinning wheel. You can move it, but will feel strong resistance. Try moving it after the wheel stops—you won't feel the resistance when the wheel is not turning.

This principle was sound, but it took time for researchers to find the right way to spin the bullet. Ultimately, shallow spiral grooves were cut into the bore of the firearm that forced the bullet to spin. A tight bullet fit was needed to make this system work. In sporting guns, a cloth patch was placed around a round ball to give the proper fit. Because these were considered short-range firearms, the long-range capability needed by the military was not a factor. The patched round ball worked so well that it is still in limited use today. The military wanted longer range for volley fire and the complicated loading procedure for the patched ball was not suitable for soldiers in the heat of battle. In muzzle-loaders, the heavy fouling generated by black powder clogs the rifling after only a few shots and a tight-fitting projectile could not be pushed down the bore after half a dozen shots.

Several methods were tried to remedy this problem in military rifles. The best solution was developed by a French officer, Colonel Minié. His design used an undersized conical bullet with a hollow base. Because the bullet was smaller than the bore, it was easy to push down the barrel even with powder fouling present. The pressure of the expanding gases upset the hollow base to give a tight seal, permitting excellent accuracy (for those days) and full power. This type of muzzleloading projectile—called the *minie ball*—is still in use today. The basics of the Minié design can also be seen today in modern revolver ammunition loaded with lead bullets.



Jacketed Rifle Bullet Cut-away

Jacketed Bullets

When the cartridge era began following the Civil War, black powder and pure lead bullets continued to be state-of-the-art technology until late in the 19th century. Soon, military firearms were designed with smaller bores to permit higher velocities for flatter trajectories. Black powder fouls small bores more quickly than larger ones; fortunately the development of nitrocellulose, or smokeless, propellants largely eliminated the fouling problem. However, another problem appeared. Smokeless propellants produced higher temperatures than black powder and caused severe barrel leading as hot gases melted the bases of lead bullets.

The solution was to put a metal jacket around the lead, opening a new era in bullet design. During the last 100 years, almost every metal alloy available has been tried as jacket materials. Steel, copper and brass have been the most common. Because copper is not a native resource for many countries, steel bullet jackets are quite common outside North and South America. With proper processing, mild steel can be made ductile enough to provide reasonable expansion in hunting type bullets.

In spite of this, the best metal for bullet jackets is an alloy of copper and zinc called *gilding metal*. Modern gilding metal bullets for reloading are designed to work well over a wide range of velocities and hunting conditions. Traditionally, gilding metal has a copper/zinc ratio of either 90/10 or 95/5. Both alloys are used in Speer rifle and handgun bullets.

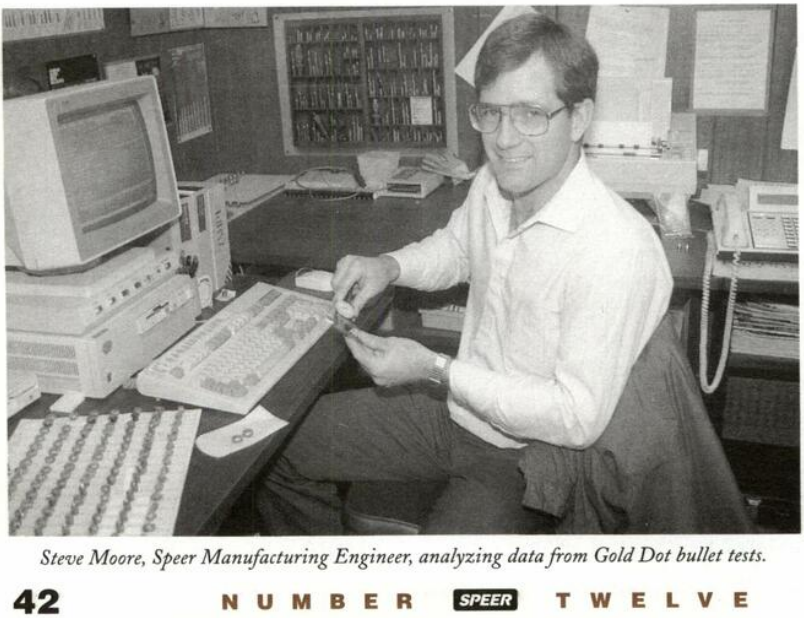
One of the appeals of reloading is the versatility offered. A wide selection of bullet types in each popular caliber lets you tailor ammunition to your specific need. Before choosing a bullet, you need to consider the type of shooting you want to do and the type of rifle you plan to shoot. Big game hunting and target shooting place different demands on the bullet than does informal plinking or varmint hunting. Different cartridges need different bullets. A 300 Magnum may not need the same bullet weight for a certain job as the 300 Savage.

As a rule, look at the range of bullet weights offered in the caliber you plan to shoot. For average game hunting requirements like whitetail and mule deer, the mid-weight bullets are fine. For example, Speer makes 30 caliber bullets ranging in weight from 100 to 200 grains. In this case, the mid-weight bullets would be the 150 to 165 grain versions. For varmints and light game, go with bullets lighter than this. For heavier game within the capability of your cartridge, choose the heavy bullets. Increased bullet weight normally means more bullet length and longer bullets provide the deep penetration required for taking heavier game.

Informal target practice—plinking—is quite enjoyable. Some reloaders use up “leftovers”, those odds and ends of bullet boxes, for plinking. If you do this, be sure of the bullet weights involved. Make certain you adjust the powder charges for bullets of different weights.

Lead Rifle Bullets

In spite of the many advances in jacketed bullet technology, lead rifle bullets are still around and can offer the reloader a new field for experimentation. RCBS and other firms sell bullets moulds in a variety of shapes and weights for most popular calibers. The home bullet caster can produce high quality lead bullets using hard alloys which resist the high pressures and temperatures of centerfire rifles. Bullets cast from a hard alloy such as linotype metal can handle velocities up to 2000 feet per second and, with care, even higher. In low-pressure cartridges like the 30-30 Winchester, cast bullets can normally be driven almost as fast as jacketed bullets of the same weight. Cast bullets can shoot as accurately as jacketed bullets and, with the



Steve Moore, Speer Manufacturing Engineer, analyzing data from Gold Dot bullet tests.

proper shape, can be used on game. Often, bullet casting becomes the only source of projectiles for many obsolete firearms. For more information on bullet casting, pick up a copy of the RCBS Cast Bullet Manual.

Bullet making has evolved rapidly in the 20th century. Today, the rejects from most commercial manufacturers like Speer will usually beat the accuracy of match bullets built 60 years ago. Improvements in gauging and tooling technology mean that today's shooter has access to bullets of the highest quality. In addition to accuracy, improvements in design and years of extensive testing have produced bullets that can deliver the exacting terminal ballistics performance demanded by the modern hunter. Speer continues its commitment to developing bullets to meet the needs of today's shooters.

PROPELLANT POWDERS

Modern propellant powders are solid chemical compounds that, when confined in a cartridge case, burn at a rapid but predictable rate to produce expanding gases. The gas produced pushes the bullet down the barrel of the firearm at high speed. Like the other components of small arms ammunition, modern propellants have evolved over the past century into the highly specialized materials that today's handloader can buy. However, for hundreds of years prior to this, black powder was the only available firearm propellant.

Black Powder

Black powder was the first ballistic propellant developed. It is a mechanical mixture of charcoal (carbon), saltpeter (potassium nitrate— an oxidizer) and sulfur. When combined in the proper proportions, an explosive mixture is created. Research indicates that the Chinese were experimenting with saltpeter-based compounds as early as 1000 AD. It wasn't until the 13th century that the western cultures began to use similar compounds for ballistic purposes.

In its original form, black powder was made simply by mixing the three powdered components together. From a military standpoint, this presented a problem. When transported over rough roads, the components tended to separate, weakening the explosive power of the mix. For some time, the raw materials were transported to the battle front separately and blended just before loading. More than a few accidents occurred while blending black powder just behind an active line of cannon!

To prevent the separation of components, a technique known as "corning" was developed. The blended mixture was dampened with water and pressed into a cake. When the cake dried, it was broken up and sifted to separate the granules by size. The granules were often tumbled with graphite to give the granules a "glazed" appearance that facilitated handling. By corning the powder, it could be transported safely without worrying about component separation and the glazing made the powder easier to load in small arms. It also provided a significant increase in power. This power boost was strong enough that some older cannon, which functioned perfectly with uncorned powder, actually burst from the additional power of the improved propellant.

With this modification, black powder has remained almost unchanged for 500 years. Black powder still has its disadvantages. Less than half of the powder converts to gas on firing. The remaining solid residue produces the thick white smoke common to black powder, along with heavy barrel fouling. Thorough cleaning with hot water is required to eliminate corrosive residues that will rust metal.

The only way to increase velocity when using black powder is to increase the charge weight. This limitation became most evident when cartridge firearms were developed. If a cartridge was to produce high energy levels, the case had to be very large. Some of the "buffalo" cartridges developed by Sharps and Winchester used cartridge cases that were a full 3 1/4 inches long! Remember that most of these "mega-cartridges" were intended for falling-block, single-shot rifles where cartridge length was not a major concern. The rising popularity of repeating rifles helped stimulate the search for a more efficient fuel that would produce high energy from compact cartridges suitable for repeaters.

Black powder is still used today. In this country, primitive firearms seasons are growing in popularity, and black powder is specified as the propellant. Black powder is still used in both muzzleloaders and cartridge firearms.

Shooters use black powder today for a variety of reasons. Some hunt with it to experience the hunting traditions of our forefathers. Others rely on the black powder hunting season to extend their time in the field each year. Cartridge rifles such as the Sharps single shots and the 1873 Springfield are commonly used with black powder. Regardless of the reason, primitive weapons and black powder will be with us for a long time to come.

Pyrodex®

(Pyrodex is a registered trademark of the Hodgdon Powder Company)

The recent growth in the popularity of black powder shooting caused some logistics problems. For shipping and storage, black powder is classified as an explosive. Local regulations may require that dealers obtain a special license for the storage and sale of black powder. Some communities ban the sale of black powder entirely.

To remedy this situation, Dan Pawlak invented a black powder substitute—Pyrodex. Pyrodex is safe to use in all black powder firearms in good condition and can be substituted volume-for-volume for black powder. Because of its chemical make-up, Pyrodex is classed as a flammable solid and falls under the same shipping and storage regulations as smokeless propellants. Pyrodex is more bulky than black powder, so a pound of Pyrodex gives about 25 percent more shots than a pound of black powder. In spite of its cleaner burning characteristics, Pyrodex still gives the shooter that satisfying cloud of white smoke with each shot. Ballistic performance duplicates that of black powder but with somewhat less fouling. Hodgdon provides loading information for Pyrodex.

Following the untimely death of Mr. Pawlak, Hodgdon Powder Company acquired the rights to manufacture and sell Pyrodex. Although this manual does not show any loads for Pyrodex, we include it in this chapter because it is a significant recent development in propellant technology.

Nitrocellulose-based Propellants

The first step toward modern propellants was the discovery of nitrocellulose in 1845-46. Nitrocellulose, also called *guncotton*, is made by the action of nitric acid on natural cellulose, usually cotton or wood fiber. The chemical reaction adds nitrogen and oxygen to the cellulose molecules. When ignited, the added oxygen causes the nitrated cellulose to burn rapidly, releasing much more energy than can untreated cellulose. A large volume of gas is generated and little residue remains.

Because it is impossible to control the burning rate of raw guncotton, it is not suitable for small arms applications. However, it became the basis for continued experimentation in explosives and other fields. It also was used to make the first plastic, celluloid, by dissolving guncotton in a strong solvent to form a sticky mass that was shaped and allowed to dry.

In the 1880's a French chemist, Vielle, found that by softening guncotton in a mixture of alcohol and ether he could form the resulting flexible solid into sheets and then cut them into small flakes. In this manner, the power of nitrocellulose could be harnessed. The material burned at a more controlled rate, allowing it to be used as a firearms propellant. Subsequent experimentation showed that by changing the granule size, burning rates could be regulated to support a wide variety of cartridge applications.

Alfred Nobel and Nitroglycerine

After Vielle's discovery of mixing alcohol and ether with guncotton to make safe nitrocellulose propellants, Alfred Nobel found that his invention, nitroglycerine, could be used alone to plasticize nitrocellulose. The nitroglycerine increased the energy of the propellant and, because no volatile solvents were used, the resulting propellants were very stable. Combining the work of Vielle and Nobel with different granule configurations gave combinations of performance characteristics that were useful in many classes of small arms.

Propellant powders manufactured with nitrocellulose alone are referred to as *single-base*; those with both nitrocellulose and nitroglycerine are called *double-base*. Both types are available to today's handloader.

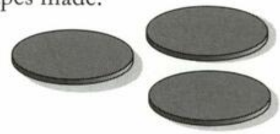
Deterrent Coatings

The development of small-bore service rifles and other military requirements demanded a slower release of energy than could be offered by granule size alone. Around 1900, chemists discovered that by adding certain chemicals to the surface of powder granules, the reaction speed could be reduced further. The effect of these coatings was a "temporary fire-proofing", reducing the burning rate by a predictable amount. Different amounts and types of deterrent coatings were used to develop a wide selection of propellants for many small arms applications. An additional benefit of deterrents is that some reduce the burning temperature of the propellant resulting in longer barrel life, especially in the chamber throat area. The sportsman has little need to worry about throat erosion, because his rate of fire and total number of shots is usually low. However, military firearms are operated at higher rates of fire and a lower burn temperature propellant can quadruple throat life.

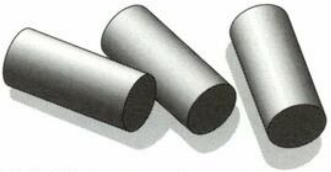
Few shooters realize that the natural color of nitrocellulose is a pale, greenish yellow. The dark gray or black color of finished smokeless propellants is normally due to the graphite coating applied to facilitate powder handling. In addition to deterrent coatings and graphite, modern smokeless propellants contain other additives to reduce flash and to stabilize the propellant for extended storage life.

Modern Powder Types

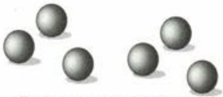
Today, propellants are usually classified by their *morphology*, or shape. There are several different shapes made:



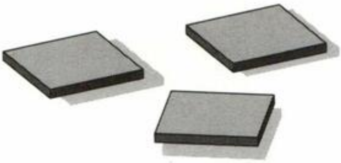
- ***Flake***— *Granules are shaped like round discs. The thickness and diameter of the flake determine the burning rate (some flake powders may be perforated to further modify the burning rate). Example: Hercules Bullseye*



- ***Cylindrical***— *Sometimes called "stick" powder. Granules are rod-shaped and may be perforated on the long axis. The length of the grain depends on the application. Examples: IMR 4064 or Hodgdon 4831*



- ***Ball***— *In its most basic form, the granules are round balls, referred to as "spherical." However, the balls may be flattened to some degree to control burning rate. Examples are: Hodgdon H380 (spherical), Accurate #9, and Winchester 748*



Sheet— Seldom seen outside of Europe, sheet powders are formed by rolling out large sheets of nitrocellulose and allowing them to partially dry. Then the sheet goes through a cutter that produces flakes which are square or diamond shaped. Examples: Alcan shotshell powders (now discontinued)

Some people call cylindrical powder "extruded powder" but this is not technically correct. All current powders start by extruding the gelatinous mass of nitrocellulose through a shaping die to form a series of strands. Just beyond the extrusion die is a cutter unit with rotating blades. These blades cut the strands into the desired length. The number of blades, speed of the blade rotation and the rate of extrusion determine the shape.

Ball powder receives different processing after extrusion. The strands are cut to form short cylinders whose length is roughly equal to their diameter. The irregular cylinders are introduced into a fluid-filled shaper and are rounded as they flow through the system. A chemical added to the fluid draws excess moisture from the granules. The particles, which are now spheroids, pass into a series of progressive evaporators to drive off residual solvents. This process produces dense spheres of single-base nitrocellulose.

After cleaning and sorting by size, the spheres are impregnated with nitroglycerine to make them double-base and coated with deterrents to produce the desired energy characteristics. If the spheres need to be flattened, this operation is performed before the granules fully harden. To meet the performance requirements, the manufacturer will often blend spherical granules with flattened ones. The reloader should not be surprised to see both shapes in the same powder sample.

Burning Rates

Modern propellants are classified as flammable solids. Although the shooter hears a single loud explosion, the propellant actually burns at a rapid rate. The release of energy through burning is called *deflagration*. The rate of energy release is the burning rate of the propellant. A propellant that releases its energy over a very short period is a fast-burning powder. One that takes longer to release its energy is a slow-burning powder.

Canister powders are often ranked in order of burning rate. However, the reloader must remember that the way a powder burns is TOTALLY DEPENDENT ON THE CONDITIONS OF LOADING. A charge of IMR 3031 in a 300 Savage loaded with a 110 grain bullet will not behave the same when loaded in a 30-06 case with a 150 grain bullet. NEVER ATTEMPT TO SUBSTITUTE POWDERS BASED ON PUBLISHED BURNING RATE TABLES. SUCH TABLES ARE PROVIDED AS A GENERAL REFERENCE GUIDE AND NOT AS A WAY TO BYPASS PUBLISHED RELOADING DATA.

For more information on burning rates, refer to the next chapter, "Velocity, Energy and Pressure".

Powder Lot Uniformity

The manufacturers of smokeless propellants make every effort to insure that each batch of powder is the same as every other batch sold under the same label. However, some minor variations will occur. For that reason, you may find loads in this manual that differ from data published in earlier editions of the Speer Reloading Manual or in data from other sources.

Even with the utmost care in manufacturing, variations between powder lots can cause pressure changes. It is for this reason that we list a lower starting load for each powder/bullet combination. NEVER START WITH THE MAXIMUM LOAD. Start with the minimum load and work up toward the maximum, carefully watching for signs of excessive pressure. This method will also provide a margin of safety when working up loads to be used in extreme temperature conditions, where pressure changes due to temperature can occur. If you have worked up a near-maximum load with a favorite powder and buy more of a different lot, drop the load five to ten percent and reestablish a new load for your current powder lot.

Propellants with Similar Names

Several powder manufacturers produce products with similar names or numbers. For example, both IMR Powder company and Hodgdon produce a version of 4831 rifle powder. First introduced by Hodgdon, DuPont (now IMR) brought out a similar propellant with the same name in 1973. IMR 4831 has a faster burning rate than H4831, and the powders are not interchangeable. Loads listed for IMR 4831 can be safely used with H4831, but NOT conversely. Substituting IMR 4831 for H4831 can cause excessive pressures. On the other hand, IMR 4895 and H4895 are usually so close in performance that the data is normally interchangeable. We strongly recommend that you follow published loads to the letter.

Pressure Variations with Temperature

The temperature of a cartridge at the time it is fired will affect the pressure it generates. A load that was safe at 40°F may prove excessive if fired at 100°F. Likewise a load developed at 100°F will likely show a velocity loss of five to ten percent when fired at 40°F. Loads for this manual were developed in the temperature range of 68°F to 74°F.

Identification of Propellant Powders

The reloader has only one way of positively identifying a propellant powder: THE MANUFACTURER'S LABEL ON THE ORIGINAL CONTAINER IN WHICH THE POWDER WAS SHIPPED. No other means of identification can be considered reliable.

Many commercial powders have similar physical appearances. In spite of this, there may be significant differences in the energy content of the powders. A wrong guess as to the type of powder can lead to property damage or serious injury. Any unlabeled powder must be considered DEFECTIVE and be discarded. Saving a few dollars on unlabeled bulk powder can ruin a fine firearm or injure the shooter and bystanders. Any powders that become mixed must also be discarded. Never attempt to blend powders to get that "special load"—it just isn't worth the risk!

Powder Storage

Proper powder storage is similar to that for primers. A cool area is best for long-term storage. Avoid large temperature changes. If you buy several cans at a time, open only one and leave the factory seals intact on the others until you need them. The original cans are designed for safe transport and storage. Keep all cans tightly sealed. If you buy a factory bulk container of powder that is too large to conveniently use on the bench, be sure that all information from the original label is transferred if you repackage part of the powder in a smaller container. Many reloaders mark the purchase date on each can. Doing this can help you judge your rate of powder usage and allows you to use the oldest stock first.

Never use glass as a storage container. When exposed to light, a "greenhouse effect" will raise temperatures inside the container, which will degrade the powder. Check cans regularly for signs of deterioration. In many powders, deterioration can be spotted as a fine red-brown dust on the granules and the inside of the can. If you see this condition in any powder, it should be considered defective and scrapped. Most single-base powders have a strong alcohol smell from the solvents used as plasticizers. The lack of this smell can indicate that the powder characteristics have changed. However, some people do not have as good a sense of smell as others, so this test is not definitive. On the other hand, a strong acrid smell that irritates the nose is a sure sign of deterioration, and the sample should be scrapped.

Storage of propellant powder is usually regulated by local fire codes. Most localities require an approved storage magazine for quantities over a pre-set minimum. For additional information, contact the National Fire Protection Association, 470 Atlantic Avenue, Boston, MA 02210. Ask for NFPA Bulletin 495, which contains storage recommendations for both the handloader and commercial distributors. Additional information on powder and primer storage and handling can be obtained from the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI), 555 Danbury Road, Wilton, CT 06897.

Current Powders

There are over 100 different component powders available to the handloader. They are usually classed by their intended use: rifle, handgun, or shotgun. However, there is some crossover. Some shotshell powders are excellent for pistol and revolver ammunition. Some quick burning rifle powders are very effective for high-velocity handloads in "magnum" revolver cartridges. Whatever your application, be sure to follow published guidelines when loading and never attempt experimentation with untested combinations.

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Within each manufacturer, the propellants are listed in approximate order of burning rate, from fastest to slowest. AGAIN, THESE RANKINGS ARE APPROXIMATE AND SHOULD NEVER BE USED TO DEVELOP LOADS THAT ARE NOT RECOMMENDED IN PUBLISHED LOADING DATA.

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Accurate Powder Co. (McEwen, TN 37101)

- *Nitro 100™— a double-base shotshell propellant intended for light target and field loads. It can also be used in mid-range handgun loads.*
- *No. 2™— a double-base ball propellant for light handgun loads such as 38 Special target loads, but suitable for light loads in most handgun calibers.*
- *No. 5™— a double-base ball propellant for medium loads in most handgun calibers. Especially suited for the 40 S&W and 9mm subsonic loads with heavy bullets.*
- *No. 7™— a double-base ball propellant that is excellent in 9mm Luger loads, 38 Super and the 10mm Auto cartridge.*
- *No. 9™— a slow-burning handgun ball propellant for full power loads in magnum revolver cartridges such as the 357, 41 and 44 Magnums. It can also be used in some small-capacity rifle cases like the 22 Hornet and the 30 Carbine.*
- *1680™— a double-base ball-type rifle propellant for small capacity rifle cases. Developed for the 7.62x39mm cartridge, it works well in cartridges of similar size. We obtained best velocities in the 22 Hornet with 1680.*
- *2015BR™— a single-base cylindrical powder flexible enough to use in many rifle cases. It was designed for smaller cases found in bench-rest competition. Excellent results have been reported in the 7mm Remington BR and similar cartridges, and 2015BR gave very good ballistics in straight-wall rifle cases.*
- *2230™— a double-base ball powder, 2230 is excellent in the 223 Remington and similar cartridges up to the medium capacity cases. Formerly known as MR-223.*
- *2460™— a double-base ball propellant for the 308 Winchester cartridge (7.62mm NATO) and similar cases.*
- *2495™— a single-base cylindrical propellant that duplicates IMR 4895. Very good in medium capacity cases with light to middle-weight bullets.*
- *2520™— a double-base ball propellant for the 308 and 30-06 class cases.*
- *2700™— a double-base ball powder designed for heavy bullets in a variety of cartridges. Useful in cartridges from the 22-250 through many of the belted magnums where bullets at the upper end of the weight range are used.*
- *4350™— a single-base cylindrical propellant that duplicates the performance of IMR 4350 and H4350 in most cartridges where a slow-burning powder is required.*
- *3100™— a single base cylindrical powder with a burning rate between IMR 4831 and H4831. Useful in large capacity cases with heavy bullets. Excellent in the 7mm Remington Magnum.*
- *8700™— according to the manufacturer, this is the slowest burning propellant available to the handloader. A double-base ball propellant, it is best suited for bottleneck, large capacity cases such as the 264 Winchester, the 7mm Remington Magnum and the Weatherby Magnums.*

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Hercules Powder Co. (Hercules Plaza, Wilmington, DE 19894)

- ***BULLSEYE®***— *a very popular double-base flake propellant for light target loads in handguns.*
- ***RED DOT®***— *a double-base flake propellant designed for shotshell loads, but also useful for light to medium handgun loads.*
- ***GREEN DOT®***— *a double-base flake shotgun propellant that can also be used in medium power handgun loads.*
- ***UNIQUE®***— *one of the most versatile propellants. This double-base flake powder can be used in a wide range of handgun loads, medium to heavy shotshell loads and, in some cases, as a reduced load rifle powder.*
- ***HERCO®***— *a double-base flake propellant for heavy shotshell loads, but also used for heavy handgun loads.*
- ***BLUE DOT®***— *Designed as a magnum shotshell powder, this double-base flake propellant can also be used for magnum handgun loads.*
- ***2400®***— *originally designed for small rifle cases like the 22 Hornet, 2400 was the first powder used in the "Magnum" pistol cartridges. Still excellent for full power loads in the 357, 41 and 44 Magnums. 2400 is double-base.*
- ***RELODER® 7***— *a double-base rifle propellant for medium size cases. Widely used in cast bullet shooting. The granules are actually short cylinders, but are so short as to appear to be a flake powder.*
- ***RELODER® 12***— *a double-base cylindrical rifle powder useful over a wide range of medium rifle loads.*
- ***RELODER® 15***— *a double-base rifle powder for medium to heavy loads in standard cases. Gave excellent results in the 35 Whelen, 375 H&H and 416 Remington Magnum.*
- ***RELODER® 19***— *A slow burning powder for heavy bullets in standard and magnum cases. Often gave top velocities with the lighter bullets in large cases.*
- ***RELODER® 22***— *Hercules' slowest burning powder intended for large magnum cases. Gave excellent performance in most of the large belted Magnum cartridges.*

Hodgdon Powder Co. (Shawnee Mission, KS 66201)

("Spherical" is a registered trademark of the Hodgdon Powder Company)

- ***HP-38®***— *a double-base spherical propellant developed for light to medium handgun loads. Widely used in 38 Special target loads.*
- ***Clays®***— *a new shotshell propellant for light target loads.*
- ***Universal Clays®***— *a double-base flake propellant similar in performance to Hercules Unique, but having a slightly smaller grain size. Universal proved excellent in a wide range of handgun cartridges.*
- ***HS-6®***— *a double-base spherical propellant for heavy shotshell loads. Also used in medium to heavy handgun loads.*
- ***HS-7®***— *a double-base spherical propellant designed for magnum shotshell loads, and also suitable for medium to heavy handgun loads.*
- ***H110®***— *a double-base spherical propellant designed originally for the 30 M1 Carbine cartridge, H110 probably sees more use in maximum loads for the Magnum handgun cartridges where it can duplicate factory performance figures.*
- ***H4227®***— *a single-base cylindrical propellant for small capacity rifle cases. Like the IMR version, H4227 can also be used in magnum revolver cartridges.*
- ***H4198®***— *a single-base cylindrical propellant having the same characteristics as IMR 4198 for 223 class rifle cases and large-diameter, straight wall cases.*
- ***H322®***— *a single-base cylindrical propellant popular in bench rest competition. Can be used in most small to medium capacity cases up to 30 caliber, plus many straight-wall cases like the 45-70.*
- ***H4895®***— *this single-base cylindrical propellant is the original version based on military powders. Probably the most flexible rifle powder capable of covering the range of calibers from 222 Remington up to the large magnums. Hodgdon reports that 4895 can be loaded to as little as 3/5 of maximum and still be efficient.*
- ***H335®***— *a double-base spherical propellant that gives excellent performance in medium capacity cases from 222 through 308 Winchester.*
- ***BL-C(2)®***— *a double-base spherical propellant that was an early favorite with the bench rest fraternity, BL-C(2) is excellent in the 222 Remington and other cases smaller than 30-06.*
- ***H380®***— *a double-base spherical propellant with a nominal burning rate between IMR 4320 and 4350. Popular with 22-250 shooters and also a good choice in most medium capacity cases up to 30 caliber.*
- ***H414®***— *double-base spherical propellant useful in 30-06 class cases. Hodgdon also recommends H414 in large capacity cases when shooting the lighter bullets.*
- ***H4350®***— *a single-base cylindrical propellant with applications similar to IMR 4350, although Hodgdon reports their version to be slightly slower than the IMR version.*
- ***H450®***— *a double-base spherical propellant with a relatively slow burning rate. Best suited to large capacity cases. Often chosen by reloaders needing 4350 performance when loading on progressive equipment.*
- ***H4831®***— *originally a military surplus powder, this slow-burning single-base cylindrical propellant is now newly manufactured to meet original specifications. A very popular powder, H4831 is best with heavy bullets in medium to large capacity cases.*

- ***H1000®***— *a single-base cylindrical propellant for overbore capacity cartridges like the 30-338 wildcat. It has a burning rate between H4831 and H870.*
- ***H870®***— *Hodgdon's slowest burning powder. This double-base spherical propellant is intended for overbore capacity magnum cartridges with heavy bullets.*

IMR Powder Co. (Plattsburgh, NY 12901)

- ***"HI-SKOR" 700-X®***— *a double-base flake shotshell propellant for target loads that is also suitable for light handgun loads.*
- ***"HI-SKOR" 800-X®***— *a double-base flake shotshell propellant for target and heavy shotshell loads.*
- ***PB®***— *a single-base flake shotshell propellant useful over a wide range of shotshell applications. Also very useful in handgun cases, where it is excellent with lead bullets.*
- ***SR 7625® and SR4756®***— *a single-base flake shotshell powder that can also be used in medium power handgun loads.*
- ***SR 4759®***— *a bulky single-base cylindrical rifle powder exceptionally suited for reduced or cast bullet loads in most rifle cases. An older powder, 4759 was dropped for a period of time but was re-introduced by popular demand.*
- ***IMR 4227®***— *a single-base cylindrical rifle powder intended for small rifle cases of the 22 Hornet and 30 Carbine class. 4227 is also used for full power loads in the large Magnum pistol cases and in reduced rifle loads.*
- ***IMR 4198®***— *a single-base cylindrical rifle powder for 223 Remington class cartridges. It is also useful in large diameter straight cases like the 444 Marlin, 45-70 and the 458 Winchester Magnum. 4198 can be used for reduced loads in other cartridges where noted.*
- ***IMR 3031®***— *the first in the famous IMR series of rifle powders, 3031 is one of the most flexible propellants on the market, working well in many cartridges. Like other IMR rifle powders, it is a single-base cylindrical propellant.*
- ***IMR 4064®***— *similar to 3031, 4064 can also be used in most rifle cases.*
- ***IMR 4895®***— *a very flexible single-base cylindrical rifle propellant. IMR 4895 was introduced after the Hodgdon version of the military propellant. Still an excellent choice in cartridges of the 30-06 class, and can be loaded at somewhat reduced levels without loosing efficiency.*
- ***IMR 4320®***— *this single-base cylindrical propellant was originally developed for loading military match ammunition. Its short cylindrical granules meter more easily through a powder measure than coarser propellants of the same class. 4320 can be used in most cases from the 22-250 up and works well in large cases with little or no bottleneck like the 375 H&H and the 35 Whelen.*
- ***IMR 4350®***— *for many years, 4350 was the slowest of the IMR series. This single-base cylindrical powder works well for maximum loads in large cases.*
- ***IMR 4831®***— *Introduced in 1973, IMR 4831 is quicker than Hodgdon H4831, and* MUST NOT BE SUBSTITUTED FOR IT. *Slower than 4350, IMR 4831 is a single-base cylindrical propellant for large cases and heavy bullets.*
- ***IMR 7828®***— *IMR's slowest propellant powder, 7828 is a single-base cylindrical powder designed for large magnum cases like the 300 Magnums. In Speer's 338 Winchester Magnum test rifle, it gave exceptional velocities.*

Olin/Winchester (East Alton, IL 62024)

Olin pioneered the manufacture of ball propellants and all listed powders are of this type. "Ball Powder" is a registered trademark of Winchester Group, Olin Corporation. All powders listed are double base.

- ***231™***— *a fast burning handgun propellant for light target loads and medium loads in the 45 Auto and 9mm cartridges.*
- ***Super-Lite™ (WSL)***— *a shotshell powder for target loads, it can also be used in light to medium handgun loads.*
- ***Super Target™ (WST)***— *a shotshell powder for skeet loads.*
- ***Super Field™ (WSF)***—*a new powder for medium shotshell loads. WSF gave excellent velocities in the 40 S&W cartridge.*
- ***Winchester Action Pistol™ (WAP)***—*a handgun propellant slightly slower than Hercules Unique, WAP gives excellent ballistics in medium capacity semi-auto pistol cartridges like the 9mm and 40 S&W. Introduced in 1994.*
- ***540™***— *a medium shotshell powder that also gives good performance in medium handgun loads. Gave excellent results in the 10mm Auto cartridge.*
- ***571™***— *a shotshell powder designed for heavy field loads, 571 also functions well in medium capacity handgun cases.*
- ***296™***— *a fine-grained pistol propellant, 296 is excellent in all Magnum revolver cartridges. Like other propellants in this class, 296 requires near-maximum loads and a firm crimp for reliable ignition and clean-burning. Speer used CCI Magnum pistol primers for most 296 loads.*
- ***748™***— *a medium rifle powder that is excellent in cases like the 223 Remington and the 308 Winchester.*
- ***760™***— *a slow-burning rifle propellant for a wide range of centerfire applications. Olin shows loads for 760 in cartridges ranging from the 22-250 through the 375 H&H Magnum.*
- ***Winchester Magnum Rifle™ (WMR)***—*Introduced in 1994, 780 is a slow-burning propellant for large magnum cases. According to Winchester, it also proved useful in the 243*

Winchester. Samples of this propellant arrived too late for inclusion in this manual.

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VihtaVuori (Imported by Kaltron-Pettibone, Bensenville, IL 60106)

These propellants from Finland were unknown in the United States prior to 1993. They cover the full range of small arms cartridges, and are now have good distribution in this country and, according to the importer, are priced similar to domestic propellants of the same class. All powders listed are single-base and cylindrical in shape.

- *N310— A fast-burning pistol propellant for light target loads in the smaller cases.*
- *N320— For shotshell target loads, but also suitable for mid-range pistol cartridges.*
- *N330— A pistol propellant useful for mid- to upper-range loads in pistol cartridges such as the 38 Special and 45 Auto.*
- *N340— A shotshell propellant for heavy field loads, but is well suited to many pistol cartridges like the 40 S&W and the 44 Special.*
- *3N37— Originally developed as a rimfire powder, 3N37 is very popular for full-power loads in 9mm Luger.*
- *N350— A magnum shotshell propellant that can also be used for full-power loads in most revolver cases.*
- *N110— A fast-burning rifle powder for small rifle cases like the 22 Hornet, N110 is also excellent in the Magnum pistol cartridges. Gives performance similar to H110 and 296.*
- *N120— A fast-burning rifle propellant designed for lighter bullets in the 5.56 NATO cartridge. Also functions well in the 7.62x39mm.*
- *N130— Designed for the 5.56 NATO cartridge when using 62 and 69 grain bullets.*
- *N133— A special purpose 5.56 NATO propellant that also proved excellent in straight-wall rifle cases like the 45-70. N133 is also very popular in the bench rest arena. The importer tells us that N133 is one of their most popular rifle propellants.*
- *N135— Designed for the 7.62 NATO cartridge, N135 is also useful in a wide variety of cartridges through 30 caliber.*
- *N140— A medium-burning propellant similar to IMR 4320 and Hercules Reloder 15. Useful for cases of moderate capacity up to 30 caliber and for the 35 Whelen.*
- *N150— An general purpose propellant for cases in the 30-06 class.*
- *N160— A slow-burning propellant for lighter bullets in Magnum rifle calibers, N160 also functions well in the 30-06 class cartridges with heavy bullets, and proved excellent in the 220 Swift cartridge.*
- *N165— VihtaVuori's slowest burning powder. Designed for Magnum rifle cases with heavy bullets.*

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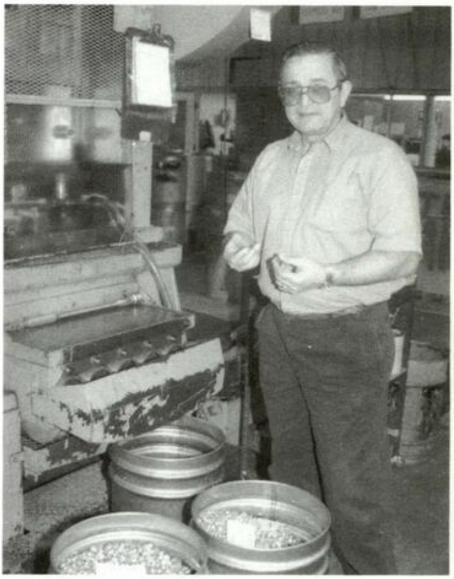
All of the listed propellant suppliers offer brochures or reloading manuals showing recommended usage for their products. Contact them for additional information on their products.



Bob Tuell, Assistant Supervisor in Speer manufacturing, checking parts on cup press.

CHAPTER 5

VELOCITY, ENERGY & PRESSURE

Velocity and pressure translate into performance and safety for the reloader. It is pressure that has the greatest influence on the safety of the reloaded cartridge. Velocity has the major influence with how the bullet behaves in flight and on impact with the target.

Velocity

Velocity is simply the speed of the bullet. Measuring bullet velocity once was a task only attempted by the most sophisticated ballistics labs. Historically, devices to measure velocities have shown an incredible amount of ingenuity, from the simple ballistic pendulum to exotic spinning-disk devices.

Improved sensing technology and advances in low-cost, solid-state electronics now make accurate chronographs available to the average reloader. Some units sell for less than $100, and are completely portable.

Modern chronographs determine velocity by accurately measuring the time it takes the bullet to travel the distance between two fixed points. The formula for calculating velocity is:

$$\text{velocity} = \frac{\text{distance}}{\text{time}}$$

If distance is measured in feet and the time in seconds, the result is velocity in feet per second (feet/sec). In countries using the metric system, velocity is expressed in meters per second (m/sec).

In the velocity formula for ballistics testing, distance is the spacing between the *screens* of the chronograph. Each screen contains a light-sensitive electronic device called a photocell. The photocell is so sensitive that it can detect the shadow of a bullet passing over it. Two screens—a start screen and a stop screen—are normal. When each screen senses the shadow of the bullet, it transmits an electronic signal to the electronics package of the chronograph

Inside the electronics package is a miniature timer called an *oscillator*. The oscillator cycles at up to one million times per second. A counter circuit logs the number of cycles the oscillator produces between the arrival of the start and stop signals from the screens. The spacing of the screens is entered by the operator with a special switch. Once the counter circuit knows the number of cycles made, the chronograph can look at the screen spacing (distance) and calculate the velocity.

For example, in a chronograph with a 1 million cycle oscillator, the counter circuit logs 2000 cycles between the start and stop signals. 2000 cycles equals 0.002 seconds. The chronograph is set for a screen spacing of 5 feet. The chronograph uses the velocity formula:

$$\text{velocity} = \frac{\text{distance}}{\text{time}} = \frac{5 \text{ feet}}{.002 \text{ seconds}}$$

which comes out to 2500 ft/sec

The calculations are performed automatically by a microprocessor chip and the readout on the chronograph displays the results for the user.

For most shooting applications, accuracy is more important than maximum velocity. A gain in velocity of 100 to 200 feet per second in typical rifle cartridges will seldom be noticeable either to the shooter or the target. Trajectory changes due to slight velocity increases are usually so small as to be of little concern to the hunter. Often, loading for higher velocity only degrades accuracy, reducing the effectiveness of the gun and ammunition.

Velocity does affect bullet expansion in hunting bullets. At low velocities, a bullet may expand very little. The same bullet fired 500 feet per second faster will expand normally. It is possible to drive a bullet fast enough to cause the bullet to break up completely. A bullet designed for the low velocities of the 30-30 cartridge might suffer excessive weight loss at the high velocities of the 300 Magnums.

Because bullet velocities are now easier for the hobbyist handloader to measure, we often get calls asking why velocities in the Speer Manual are different from those the shooter gets from the same load in his rifle or handgun. The answer is simple: all firearms are different. Variations in bore smoothness, chamber dimensions, throat shape, headspace and other factors combine to make each firearm unique. Throw in external factors like temperature, powder lot variation, case construction and primer differences and you can see why you can measure differences in velocities between seemingly identical firearms. For an excellent discussion and examples of velocity variations, please read the section, "Why Ballisticians Get Gray" immediately following Chapter 13 in the handgun section of this manual.

In the Speer manual, we develop the loads in industry test barrels, but report velocities recorded from popular sporter rifles and handguns with common barrel lengths. This way, velocities are more meaningful to the average reloader than velocities reported from test barrels. Just keep in mind that your rifle or handgun probably won't produce exactly the same speed as ours.

Energy

Energy is defined as the ability to do work. The energy of a object in motion is called *kinetic energy* (KE). Kinetic energy is expressed in foot-pounds. It is not directly measured; rather, it is calculated from the bullet's mass and velocity. Any object having mass and velocity has kinetic energy. The basic formula for calculating energy is:

$$\mathrm{KE} = \frac{\mathrm{mv}^2}{2}$$

where m is the mass of the bullet and v is the velocity. Mass and weight are not the same. To get the results to come out correctly in the English unit of energy, the foot-pound, the following formula is used. It contains the necessary conversions into English units:

$$\mathrm{KE}_{\text{foot-pounds}} = \frac{\text{velocity}^2}{450400} \times \text{bullet weight}_{\text{grains}}$$

For example, the energy of a 150 grain bullet travelling at 2800 feet per second can be calculated:

$$\mathrm{KE} = \frac{2800 \times 2800}{450400} \times 150 = 2611 \text{ ft-lbs}$$

The average hunter will normally not need to worry about the amount of energy his load generates. The only exception is that some states specify a minimum amount of muzzle energy for big game hunting, for example 1000 foot-pounds.

Pressure

Throughout the data pages in this manual, you will find references to pressure. This is the peak pressure generated by the expanding gases as the powder charge burns in a cartridge case. Maximum operating pressures for each cartridge are established by the Small Arms and Ammunition Manufacturers Institute (SAAMI). These pressure standards take into consideration the types of firearms in which each cartridge will be used. Cartridges commonly used in a weak action will have a lower pressure standard than ones used in strong actions.

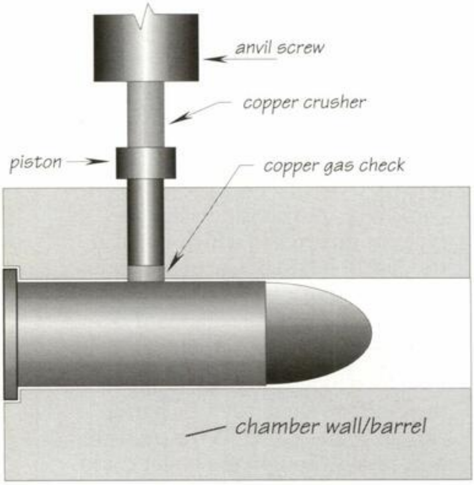
Pressure does the work to move the bullet through the rifle barrel and on to the target. If the pressure is not high enough, the bullet could stick in the bore or fail to generate enough velocity to do the intended task. If the pressure is too high, the firearm may be damaged and the shooter injured.

The weak link in a shooting system is the brass cartridge case. Even though a strong rifle action may have a yield strength of 160,000 pounds per square inch, the best brass case will withstand much less than half that amount. For that reason, it is important to comply with published loading data from reputable bullet and propellant manufacturers. NEVER EXCEED RECOMMENDED LOADS. As you read on, you will see that accurate pressure testing is not something that the typical hobbyist can do for himself.

There are two different methods recognized by the American firearms industry for the accurate assessment of cartridge pressures. In both systems, a heavy barrel with very precise chamber and bore dimensions is mounted in a rigid mechanism known as a universal receiver.

Crusher Pressure Measurement

Crusher pressure measurement is the older of the two systems. This system determines pressure by correlating the amount that a cylinder of copper is crushed to the pressure of the expanding gasses.



Basic layout of Crusher/Pressure Gun

The pressure barrel's chamber has a hole in the side, perpendicular to the chamber. After a case is inserted, a copper seal— the *gas check* — is placed in the hole and seated against the side of the cartridge. A steel piston is placed in the hole and a copper cylinder is placed on top of the piston. A heavy steel yoke with a large anvil screw is then installed and tightened to hold the assembly in place.

Copper Crushers— before and after firing.

The crusher cylinders are of known metallurgy and each lot of crushers is calibrated. A tarage table is furnished with each crusher lot showing how much pressure is required to compress the crusher a given amount.

When set-up is complete, the cartridge is fired and the crusher cylinder is removed. The compressed cylinder is measured and the operator finds that length reading in the tarage table. Beside the length in the table is a number that is the chamber pressure expressed in *copper units of pressure* (c.u.p.). The test set-up must be repeated for each shot.

Piezoelectric Pressure Measurement

This is a newer system that provides faster readings through the use of electronics. A sensor called a transducer is mounted in the chamber wall. It contains a piezoelectric crystal that generates a small electrical charge when compressed. The strength of the electrical signal is directly proportional to the pressure applied to the transducer. When the cartridge fires, the electrical signal is feed into a processing unit to be converted into a pressure reading in *pounds per square inch* (psi). Because the set-up does not change for each shot as in the crusher system, data can be gathered more rapidly. Both transducer and crusher systems were used during the development of the data presented in the Speer Reloading Manual.

In Europe, transducers are also used but are of a different type that are usually mounted at the case mouth instead of against the sidewall of the case. This difference in transducer location can mean that loads developed on the European system may be different than those tested by SAAMI protocols.

Calibration of Pressure Guns

Both the crusher system and the piezoelectric system give raw pressure readings. However, because of slight variations from barrel to barrel, each barrel must be calibrated with reference ammunition for pressure readings to be compared against industry standards. These standards are set within the firearms industry by the Sporting Arms and Ammunition Manufacturers Institute (SAAMI).

Reference ammunition consists of special lots loaded under tight tolerances and assessed to determine actual pressure value. Each SAAMI member obtains reference ammunition for the cartridge to be tested and fires it in his pressure barrel. The raw reading is compared to the published value of that specific reference lot. The difference between the raw number and the assessed reference value is the pressure correction factor. For example, a manufacturer fires reference ammunition in his 30-06 pressure gun and gets a raw reading of 50,300 cup. The published value of the reference lot is 48,600 c.u.p. The manufacturer must correct his raw reading by subtracting a *correction factor* of 1700 c.u.p. In this manner, the barrel is "zeroed" against a known standard.

Reference ammunition is available only in standard calibers recognized by SAAMI. It does not exist for wildcat, obsolete or some foreign cartridges. Therefore it is not possible to get corrected pressure readings for ammunition that is not a standard SAAMI cartridge. Safe working pressures for a particular rifle for a non-SAAMI cartridge must be established by other means.

Case Head Expansion

When the cartridge is a non-SAAMI cartridge like a wildcat, an obsolete or obscure foreign cartridge, normal crusher or piezoelectric pressure testing will likely not be possible. In these cases, an older and less precise method of pressure assessment is used.

When a case is fired, the solid brass portion of the case head will expand slightly due to the rearward thrust of the expanding propellant charge. The amount of expansion is measured with a micrometer at a point just above the rim or the extraction cannelure on the solid web area. Readings taken on the rim will be inaccurate. Note that the normal bulge of the case is not the point where the measurement is made.

Case head expansion testing should be made with once-fired cases of the same make and from the same production lot. The hardness of cartridge brass varies; a softer lot of brass will deform at lower pressures than a lot made from harder brass. For measurement, a blade micrometer accurate to 0.0001" is mandatory. The more common 0.001" micrometer will not give the accuracy required and must not be used.

New cases can give deceptive readings. The first firing of any case will usually cause more deflection of the brass than subsequent firings. At Speer, we start with once-fired brass so the initial deflection is already accomplished.

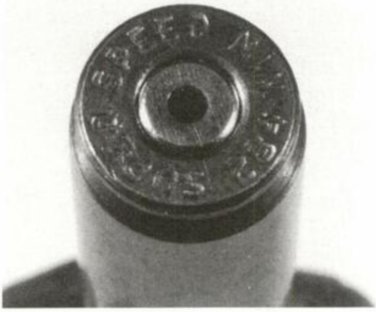
Once-fired cases are loaded and each one is carefully measured. After firing, each case is measured again at the same point and the difference in diameter is calculated. We look for an average expansion of .0003" with no individual reading over .0005". You can see that this is very precise and slow work. Case head expansion measuring .0003" to .0005" is generally accepted as representing pressures in the 50,000 c.u.p. range with typical cases.

Because copper alloys including brass work-harden, we use cases for only three firings before retiring them from this testing. If cases are used until work-hardening sets in, a false reading can occur.

Remember that this method does not give absolute pressure. It is only a relative indication and results can vary among rifle and cases. USE PUBLISHED DATA WHENEVER POSSIBLE.

Primer Appearance

The art of "reading" a fired primer to approximate pressure has received a lot of attention. It is true that excessive pressure can be detected by interpreting the appearance of a fired primer; however, the reloader must be aware of pitfalls that can lead to erroneous conclusions.

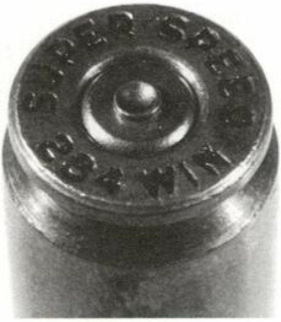


Pierced Primer

Pierced primers are sometimes assumed to be indicative of high pressures. However, most pierced primers are the result of a rough or improperly shaped firing pin. Even a small burr on the tip of a firing pin can cause the primer to pierce. The same result could occur from a well-polished firing pin that is too sharp. When you see a pierced primer, check the condition of the firing pin before making a judgement about the load.

In some firearms, excessive clearance between the firing pin and the breech face can cause the indented portion of the primer to fall out. The case looks like someone drilled a hole in the primer, although the primer retains its radiused edges indicative of normal pressure. Again, this is a gun problem and should be corrected before further shooting. If this type of gas leak continues, the breech face can be eroded.

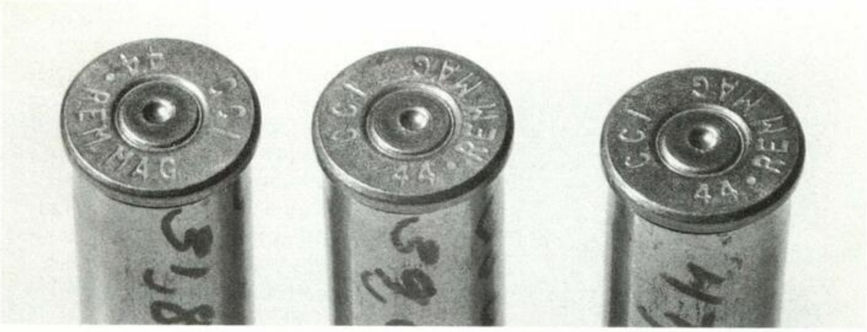
Primers that back out of the pocket seldom indicate a high pressure condition. In fact, the opposite is more often true; low pressure is likely the culprit. All sporting firearms have a certain amount of clearance between the breech face and the cartridge. This allows a little room for powder residue and dirt to accumulate that may prevent a malfunction when the firearm is used under dirty conditions. When a primer fires, it generates its own level of pressure even before the propellant charge



Cratered Primer

fully ignites. This initial pressure causes the primer to back out of the primer pocket until it is stopped by the breech face. When the propellant charge reaches peak pressure, the cartridge case is driven back until it is also stopped by the breech face and the protruding primer is reseated. If the operating pressure is low, there isn't enough force to drive the case back and the primer remains backed out.

Flattened primers are another sign often used as a indicator of high pressures. Although more reliable



44 Magnum cartridges (l to r), 31,800 C.U.P., 39,000 C.U.P., 47,700 C.U.P. No visible difference in primer appearances.

than pierced primers and protruding primers, flattened primers can result at normal pressures. The thickness of the primer cup, its shape, metallurgy and the headspace of the firearm can create flattened primers.

Magnum primers for handguns generally have thicker cups than standard primers. Replacing a standard primer with a magnum primer will usually eliminate flattening, even though the hotter magnum primer probably raises pressures slightly.

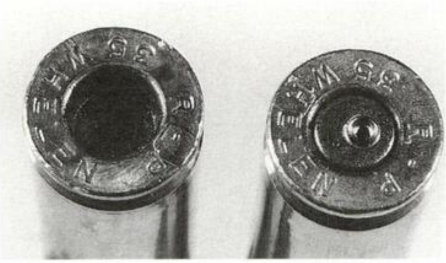
Excessive headspace can cause severely flattened primers at safe working pressures because the primer backs out much more than normal before the powder charge ignites. As pressure builds, the primer begins to "balloon" due to a lack of lateral support and, when reseated by the set-back of the case, the edges tend to fill the pocket. Primers in the same load fired in a firearm with proper headspace would appear normal. Firearms suspected of having excessive head-space must be inspected and repaired before shooting them further.

A recent test by the Speer staff clearly shows the folly of trying to read primer flattening as a sign of excess pressure. Three 44 Magnum loads were developed. One was at maximum working pressure, one was 20 percent under maximum and one was 20 percent over maximum. All three loads were fired in a production revolver. In spite of the fact the loads cover a range of 16,000 c.u.p., no difference was apparent among them based on primer appearance!

Of course, a primer flattened so much that it flows into the radius of the primer pocket, filling it entirely, is definitely a sign of high pressure if the firearm is known to have proper headspace. Usually, this condition results in a stretched primer pocket which will no longer hold a new primer securely. At even higher pressures, the fired primer may fall out when the bolt is opened. At this point, the load is severely over any safe pressure.

Primer extrusion, or "cratering", is often incorrectly cited as being signs of excess pressure. Extrusion is evidenced by a ridge of metal around the firing pin indent. In most cases, these are not pressure indications but rather gun problems. Extrusion can be due to excessive clearance between the firing pin and firing pin hole in the breech face or due to a weak firing pin spring. Changing from a standard primer to a magnum primer (with appropriate load adjustments, of course) will usually reduce the symptoms, but the best action is to have the gun problem corrected.

Occasionally, a dark, sooty ring will be noticed between the primer and the case. Although it can be caused by high pressure, the presence of this ring on otherwise normal primers indicates a primer pocket leak. The most common cause is a damaged primer pocket. If the sidewalls of the pocket are badly scratched, the normal sealing action of the primer cannot stop all the gas. Primer leaks can also be caused by very old primers that



The case on the left clearly shows high pressure.

have developed age cracks in the side-walls or from a loose primer pocket. If you notice primer leaks, try a different lot of cases or primers. When cleaning primer pockets, avoid using tools that gouge the sidewalls of the pocket.

If you notice primer leaks, stop shooting that ammo immediately. Continued firing may damage the breech face of the firearm.

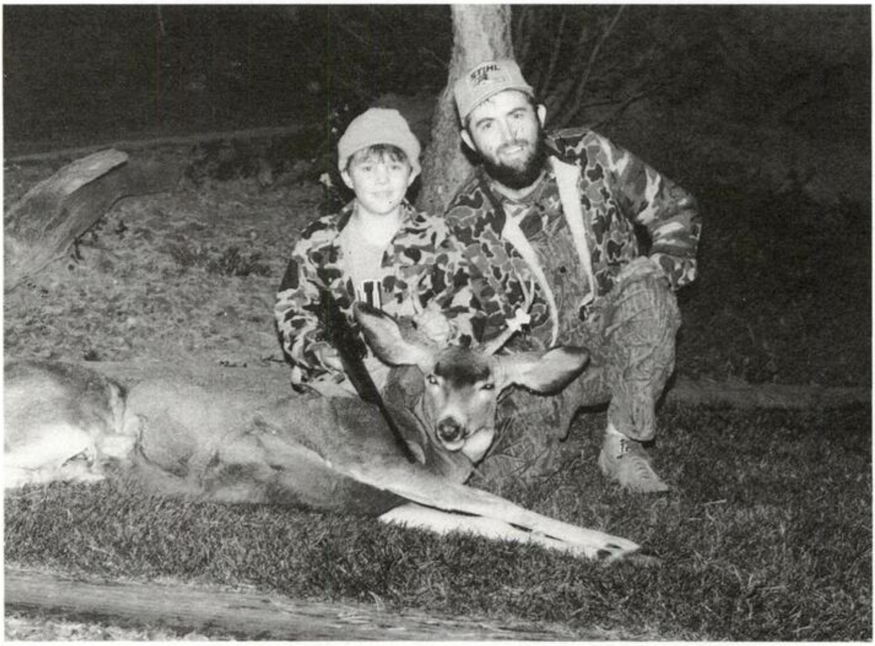
Appearance of the Fired Case

Although primers can give false pressure indications, the brass case itself can show symptoms that are absolutely indicative of excess pressure. As normal pressures are passed, a bright mark may appear on the case head at the point where the breech face is cut away for the extractor and/or ejector. As pressures increase, the brass begins to flow into these recesses. Usually the primer pocket will enlarge excessively at this point. If these signs are seen, you have gone far beyond any safe pressures! The next step is a ruptured cartridge case. REMEMBER: THE BRASS CASE IS THE WEAKEST PART OF THE SYSTEM. WHEN IT FAILS, DAMAGE TO THE FIREARM AND INJURY TO THE SHOOTER CAN OCCUR.

Assumptions Concerning Pressures

Like most people, reloaders like to generalize. It is always comforting to have things around us fall into predictable patterns. Unfortunately, theory sometimes collides head-on with reality.

Reloaders recognize certain generalities or assumptions regarding ammunition pressure. We assume that adding more powder increases pressure. Likewise, changing to a heavier bullet without adjusting the powder charge is



Dave Imthurn, CCI/Speer Engineering Technician, with son Tony and his first deer. Tony personally handloaded his own ammunition too. (7mm-08, 130 gr. Spitzer) assumed to create more pressure. Most of the time these assumptions are correct. However, interior ballistics is an inexact science. We don't mean to imply that the test methods or the people involved are sloppy. In fact, the accepted test procedures are the best available and the technicians performing such tests are highly skilled and strive for excellence, no matter where they work. It is the cartridge and its components that produce any lack of exactness.

Modern propellants powders are hard to "pigeon-hole". They are remarkable chemicals which provide the shooter with maximum performance and quality. However, their burning characteristics are not constant—*they vary depending on the case volume and the pressure level used.* Powder burning rate charts are ranked based on the performance of the powder in a specific test condition. For these tests, the heat and pressure production are measured in a closed, fixed-volume device called a *calorimeter bomb.* When you look at a burning rate chart, the rankings you see are based on this test. IN A CARTRIDGE CASE, THESE RANKINGS MAY NOT BE THE SAME. It is precisely this reason that the home reloader, without the benefit of laboratory equipment, must not attempt to substitute propellants based on burning rate charts. We found that some powders "flip-flop" their published burning rate positions depending on the cartridge and the pressure level.

Other variables enter the picture when you're talking about a "real world" gun system. One of the variables is bullet construction. As you have seen, Speer uses several different manufacturing techniques to build its bullets. This gives reloaders access to different types of terminal performance. However, it also means that each bullet style has a unique effect on pressure depending on how much force is required to propel it down the barrel.

Bearing surface is a major player. It is the amount of the bullet shank that is direct contact with the bore. Speer's .458" 350 grain Hot-Cor bullet produced lower pressures than a bullet of another make that, although the same weight, had a much longer bearing surface. Speer TNT varmint bullets are designed with the minimum bearing surface required to maintain accuracy. As a result, the difference in maximum charge weight between the TNT and other Speer hollow points of similar weight can be significant. For example, when we compare the .308" 125 grain TNT to the .308" 130 grain hollow point in the 30-06 cartridge, there is often a one- to two-grain difference for the same powder—more than you would expect for only a 4 percent bullet weight difference.

Warren Cloninger, CCI/Speer Ballistic Tech., prepares handloads for pressure testing data to be included in the Speer Manual.

The thickness of the bullet jacket has an effect. Thin jackets are more susceptible to in-bore deformation than thicker ones. Thin jackets are pressed against the bore harder, and can raise pressures. When load data is developed for a cartridge, we test all the Speer bullets of the same weight, and develop the data with the bullet that produced the highest pressure.

Remember that bullets of different makes will give different pressures. The variety of jacket alloys, shapes and manufacturing techniques all contribute to pressure changes. The data in this manual was developed and intended for Speer bullets. The data presented may not give the same pressure and velocities if bullets of another make are used.

Primer changes produce different pressures, too. A load developed with brand "A" will seldom develop the same pressure as one developed with brand "B", even though all other components are the same. Cases from different manufacturers have different internal volumes. All these affect the working pressure of the cartridge. Without testing equipment, the reloader cannot know if these changes are up or down.

We are occasionally asked why we don't show pressures for each load. We leave this information in the file for a very good reason. Some reloaders look at a pressure value and think, "This load is 3000 c.u.p. below the published pressure limit. I can add a grain more powder and be right at the limit."

Well, this is a bad assumption. It may be that a grain more would really be "right at the limit", but it could just as easily produce excessive pressure. In the load development for this manual, we found many instances where adding just one more grain did exactly that—the pressure went well over maximum. Not every powder produces this effect, but lacking standard test equipment, the hobby reloader doesn't know. It cannot be assumed or predicted without accurate lab testing.

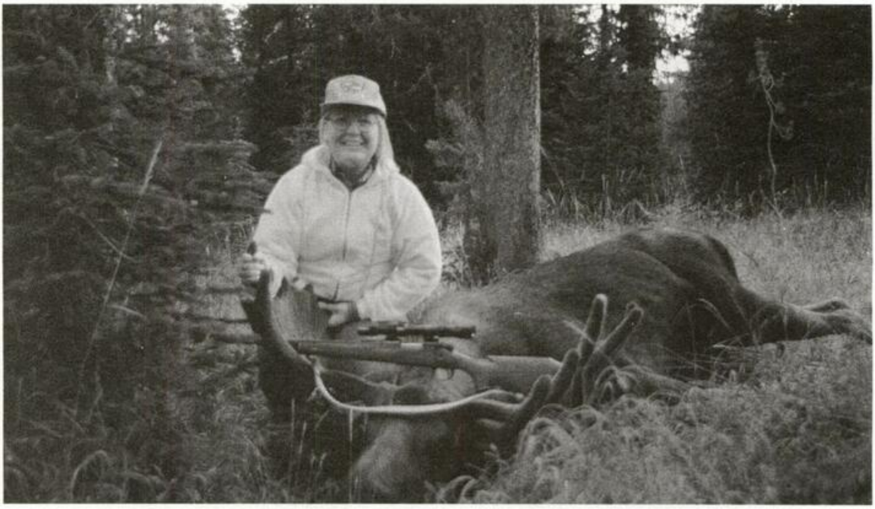
Here are some common pressure relationships:

- *An increase in bullet weight increases pressure, but not always.*
- *A thin bullet jacket causes higher pressure than a thick one, but not always.*
- *A long bearing surface causes higher pressure than a shorter surface, but not always.*
- *Changing from a standard primer to a magnum primer increases pressure, but not always.*

We could go on with this list, but won't. Look at the last phrase of each of the assumptions. It reads "*...but not always.*" This should tell you that assumptions may be wrong. It is for this reason that you may see load data in this and other manuals that doesn't "track" as bullet weights or types change in the same cartridge.

All of this reinforces two points we've deliberately made in several places in this book:

- *Always follow published load data.*
- *Always begin with the starting loads and work up in small increments toward the maximum, watching for pressure indications at each step.*



Kay Curran, CCI/Speer Shipping Dept., proudly sits alongside her very fine Idaho moose. (.308 caliber, 165 gr. Grand Slam)

CHAPTER 6

SAFETY IN RELOADING

Reloading is a safe and enjoyable hobby that requires no special skills beyond the ability to read, understand and follow instructions. To keep it safe, certain safety guidelines must be followed. By knowing the potential hazards and following well-established guidelines, the average shooter can satisfy his need for quality ammunition without suffering any injury or property damage.

Reloading Safety Rules

WARNING: FAILING TO ADHERE TO THE FOLLOWING SAFETY RULES CAN RESULT IN PROPERTY DAMAGE AND/ OR SERIOUS PERSONAL INJURY. READ AND UNDERSTAND THEM BEFORE ATTEMPTING TO RELOAD AMMUNITION.

General

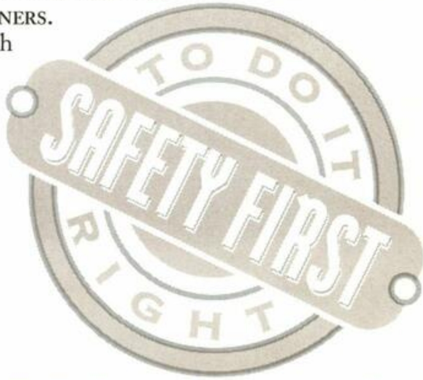
1. ONLY RELOAD AMMUNITION WHEN YOU CAN GIVE YOUR FULL AND UNDIVIDED ATTENTION. Do not reload when fatigued or ill. Allow plenty of time to load ammunition so that you don't feel rushed; load at a leisurely pace. Don't try to reload while watching television or engaged in conversation. Limit your visitors. Set up your reloading equipment in a quiet area where you will not be constantly interrupted. Never attempt to reload while under the influence of alcohol or medications. Keep children out of the loading area until they are old enough to learn and understand the processes and will obey your instructions.

2. THOROUGHLY READ AND UNDERSTAND EQUIPMENT INSTRUCTIONS BEFORE USING THE EQUIPMENT. All manufacturers of reloading equipment furnish thorough instructions in the safe operation of their equipment. If no instructions are available, contact the equipment manufacturer to request a copy BEFORE attempting to load ammunition.

3. WEAR APPROVED SAFETY GLASSES DURING ALL RELOADING OPERATIONS, AND WHILE SHOOTING. Such eye protection reduces the risk of eye injury from flying particles. Make safety glasses available for others who might be in the loading area.

4. OBSERVE "GOOD HOUSEKEEPING" IN YOUR LOADING AREA. Store all components in their proper places and keep tools clean. Clean up any spilled propellants or primers promptly and completely. Limit the components on your loading bench to just those needed for one load.

5. KEEP COMPLETE RECORDS OF YOUR RELOADING DATA AND ACCURATELY LABEL ALL AMMUNITION CONTAINERS. Many reloaders use a log book to show which loads were assembled on a particular day. This system also makes it easy to monitor component usage when working up a component order. Make certain each container of reloads is immediately and properly labelled. Each box of Speer bullets comes with adhesive labels that can be attached to ammo boxes for positive load identification. NEVER try to guess at the identity of any ammunition.



Powder and Primers

6. Store primers and powder away from heat, open flames and sources of electricity. Keep these items out of the reach of children. Do not smoke during any reloading operation.

7. Keep propellant powders in their original approved containers with all labelling information intact. Do not use any propellant unless its identity is positively known. Scrap any propellant for which you do not have positive identification. Purchase powders from a reputable source and avoid powders that have been transferred from their original containers or relabelled. Scrap any propellants that become mixed or contaminated.

8. Keep no more than one can of propellant on the loading bench at a time to avoid mixing powders. A good layout for the loading area is to have all propellants stored away from the bench except for the can being used. If you move powder from the original canister to another container such as a powder measure during the loading operation, be sure to return the unused portion to the original container immediately after that stage of loading is completed. Empty powder measures and tricklers at the end of each session. It's a good idea to place a sticker on the outside of the powder measure to clearly show which powder is currently in the measure.

9. Carefully read and follow published load recommendations. Before loading, verify that the data is for the cartridge you are loading. It is easy to have a manual open to the 300 Weatherby Magnum data instead of the 300 Winchester Magnum.

10. Do not attempt to reload without a reliable powder scale. Even when using an adjustable powder measure, it is absolutely mandatory to use a scale to insure accurate settings. Never guess at a powder weight. Check the zero adjustment before each loading session or when the scale is moved to another location. Once a month, or whenever the scale is cleaned, moved or bumped, verify the accuracy of the scale with an RCBS Scale Weight Check Set. Make sure the scale is placed on a level surface. Clean the scale often; sometimes small amounts of dust in the bearings can result in incorrect readings. Use a soft brush to remove dust from the bearings. Do not locate the scale within three feet of a fluorescent light. Under certain conditions, the electro-magnetic field generated by these lights can cause scales to read incorrectly.

11. Store primers only in their original containers for safety and to insure proper identification. Primer packaging is carefully designed to provide primers with maximum protection from heat or impact. Return unused primers to their original package. Never store primers in a bulk container. Loose primers in a can, jar or containers other than the original package can be very hazardous should they detonate and can cause severe injury and/or property damage. Never apply excessive force when seating primers. If a primer seems unusually difficult to seat, cease loading operations until you determine the cause of the problem.

- Do not attempt to use primers whose identity is unknown. These primers should be scrapped. Disposal of live primers must be done in accordance with applicable ordinances and regulations in your area.

- Recent testing has revealed that soaking primers in oil desensitizes them to impact by raising the ignition temperature of the chemical mix. This prevents them from being fired upon impact; however, oil-soaked primers can still detonate if subjected to high temperature, such as in a fire.

12. Priming tubes. Do not store primers in priming tubes. Use care in filling and handling loaded tubes. Dropping a tube, even if only partially loaded, can result in an explosion. Periodically check tubes for primer residue, and if any is found, do not use them until they have been cleaned. Tubes can be cleaned by holding them under water and gently brushing with a plastic brush or small cleaning patch. Make sure cleaned tubes are completely dry before using. Never apply oil to primer tubes because it can contaminate primers or leave a sticky residue that will retain primer dust.

- When filling tubes, apply no more than five (5) pounds of force to insert primers. This can be measured by placing the primer tray on a bathroom scale and watching the dial as you press the tube over the primers. If more than five pounds of force is required to insert primers, examine tubes for damage and replace if necessary.

- Never use a primer tube of one make with reloading equipment of a different make. Even though tubes may appear similar in size, any mismatch may cause poor primer feeding with the risk of detonating primers. Never attempt to build and use homemade tubes for the same reason.

13. Progressive reloading equipment. Progressive reloading equipment has automated features that require more attention and care than do single-stage presses. Before using a progressive reloader, read Chapter 13, "Automating the Reloading Process."

Loading Data

Most of the loads shown in this manual were developed using industry standard pressure testing equipment and techniques. Maximum loads shown do not exceed published industry pressures unless noted otherwise. Certain older cartridges whose pressure limits were originally set relatively low have seen a new popularity because of their reintroduction in modern, strong firearms. Examples are the 7mm Mauser, 32-20 Winchester, 45-70 and 45 Colt. In these cases, the reloading data are clearly identified as being only for modern firearms and the acceptable loading practices for older firearms are specifically mentioned.

> Notice: The reloading data contained in this manual represent the most recent recommendations and were developed using current propellant lots and standards for pressure. This data obsoletes, replaces and supercedes all data previously published by Speer, Inc., Omark Industries or Blount, Inc. These loads are for Speer bullets. Substituting bullet of other makes may cause excessive pressures.

Because no industry pressure standards exist for wildcat and proprietary cartridges, recommended loads were developed using the technique of monitoring case head expansion.

14. Never start with a maximum load. For every load, start with the minimum powder charge. Work up in small increments to no more than the listed maximum, carefully watching for any signs of excessive pressure. Even though maximum loads are within industry specifications, they may not

TO DO IT
SAFETY FIRST
RIGHT

function properly or exhibit excessive pressure signs in a particular firearm, especially in a custom or foreign model having non-standard chamber or bore dimensions.

- Manufacturers of propellants strive to make every lot uniform when compared with prior lots of the same powder. However, some minor differences do occur. This is another reason to start low and work up toward the maximum. The powder lot which Speer used to develop the data shown may not be exactly the same as your lot.

15. Use only light to moderate loads until your experience increases. New reloaders need a little time to grow accustomed to the equipment and the reloading operations. Avoiding maximum loads during this learning period insures having an extra safety margin.

16. Always observe recommended load data. Reloading manuals like this one are basically "recipe books" for handloaders. However, unlike a cookbook, reloading manuals are not intended to be a "jumping-off point" for wild experimentation. The component combinations shown in loading manuals have been carefully selected and tested for compatibility with the cartridge being reloaded. Going outside these recommendations is an invitation to disaster!

- We receive calls and letters asking, "Isn't this data really conservative? Can't I go higher?" The answer to both is "ABSOLUTELY NO!" The maximum loads are just that—MAXIMUM! DO NOT EXCEED THESE LEVELS UNDER ANY CIRCUMSTANCE.

17. Never mix propellants. Blending powders to get a particular performance level is extremely hazardous. Stick with standard commercial propellants.

18. Always reduce loads when changing components. Changing components can affect pressures. If you have worked up a load with one set of components and then need to change part of the combination—a different brand of cartridge case, for example—reduce the load at least 10% and work back up in steps. Small cases are much more susceptible to pressure changes than large ones. In most standard sporting cases, a reduction of 10% is sufficient, but in small cases like the 22 Hornet or 218 Bee, a reduction of up to 20% may be necessary.

Lead Exposure

In recent years, there has been a growing concern over the toxic effects of lead. At high exposure levels, lead can cause serious physical impairment. Some individuals are more susceptible than others. Because certain reloading components contain lead or lead compounds, it's possible to be exposed during reloading. Primers and bullets contain lead, and lead residue is present in fired cartridge cases. Lead can enter the body in several ways, but the most likely avenues are through the nose and mouth. However, with simple precautions, the hazards of lead exposure can be avoided.

- Observe good hygiene. Wash hands thoroughly with soap as soon as you finish loading or shooting.

- Never eat or drink while reloading. Residue containing lead can get on your hands. Eating anything that requires direct hand contact with food means you are ingesting lead. Keep your hands away from your nose and mouth while loading.

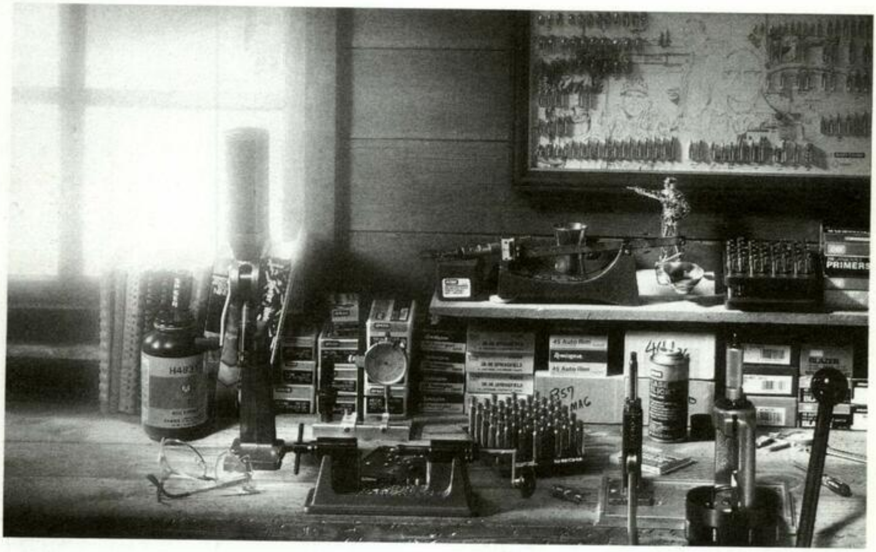
TO DO IT RIGHT
SAFETY FIRST

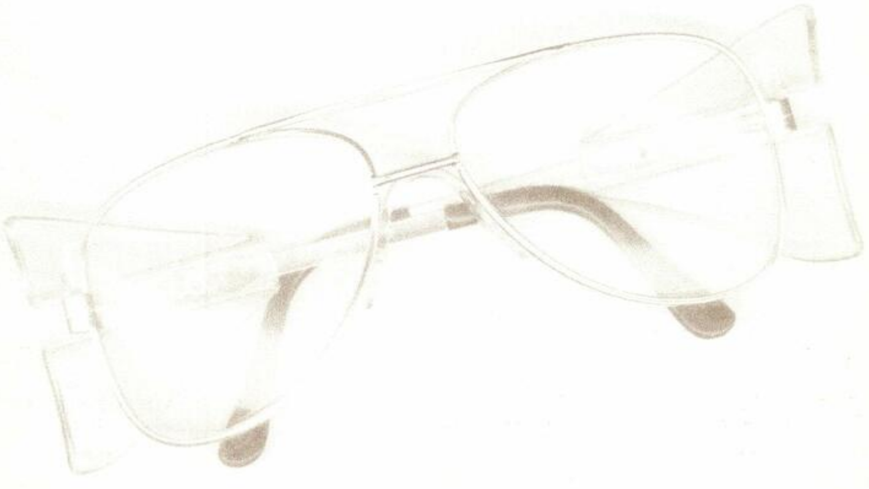
• Avoid breathing dust in the reloading area. Wear a dust mask when working with dry case cleaning media. Lead residue from fired cases builds up with use. When pouring the media into and out of a case cleaner, use a mask to avoid any dust that might escape from the media.

• Keep the loading area clean. Regular cleaning will prevent the build-up of residues, including those containing lead. Clean bench surfaces with a damp cloth. If the area has a hard-surface floor, the preferred way of cleaning is damp mopping. When possible, avoid using carpet in loading areas. In addition to being harder to clean, carpet can produce static electricity that can lead to primer mishaps.

Summary

Following these guidelines will help insure that your reloading experiences are always safe. Don't let these safety rules scare you—observing them is simple. Make them a part of your reloading routine from the start, and enjoy your hobby to the maximum.

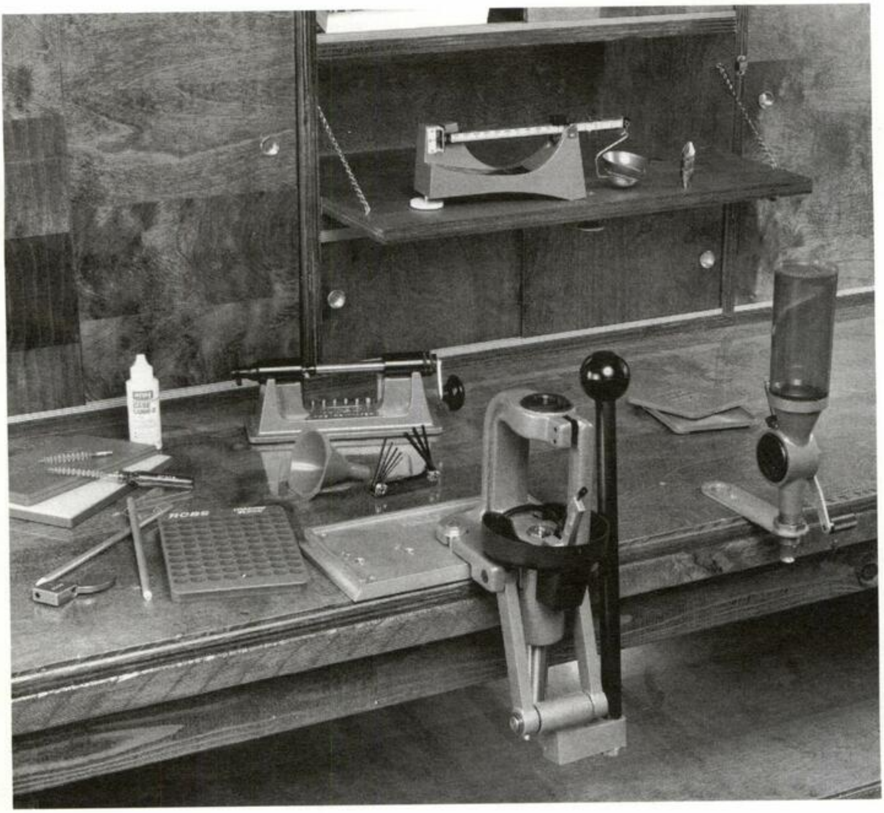




CHAPTER 7

FROM THE LOADING BENCH TO THE RANGE

[A Step-by-Step Guide to Reloading Rifle Cartridges]



Reloading requires an initial investment in the tools and equipment needed to assemble ammunition. Because of the wide range of reloading equipment available, the cost of getting started can vary quite a bit. However, the savings in ammunition costs will soon recover your investment in hardware.

Minimum equipment required:

• **A quality reloading manual**— if you're reading this, you've already made the most important purchase. Safe reloading can only be accomplished with proper instructional material and published, lab-tested loading data. NEVER GUESS AT A POWDER CHARGE OR BULLET SELECTION. Use only published data from a reputable bullet, powder or reloading equipment manufacturer.

• **A place to load**— reloading equipment should be set up in a reasonably quiet area where you can give your undivided attention. The area should be well lighted and comfortable. A garage workshop can get very cold in the middle of winter unless it has a heater. Many reloaders who start in the garage soon find that a reloading area in the house becomes a priority. For safety, the area should be one that can be secured to prevent children and others from tampering with your equipment and components.

- **A reloading press**— the press gives you the mechanical advantage required to recondition the cartridge case. The press also holds the next two equipment items—the reloading dies and shell holder—in perfect alignment. RCBS makes four single-stage presses from the economical Partner™ press to the powerful AmmoMaster™. All RCBS presses include the hardware needed to prime cases. Reloading presses are designed expressly for reloading ammunition and you should never attempt to cut corners by using an arbor press or a vise as substitutes.

- **Reloading dies**— normally you will need only one press to reload metallic ammunition, but you will need a different set of loading dies for each cartridge that you wish to load. Don't cut corners by trying to load a cartridge of one caliber in a set of dies intended for another caliber.

Die sets for bottleneck rifle cartridges like the 30-06 consist of two dies. The *sizing die* reshapes the brass case to the dimensions needed to permit easy chambering in standard rifles. This die also insures the case neck is the proper diameter to grip a new bullet and ejects the spent primer. The *seater die* aligns the bullet with the case and pushes it to the desired depth in the case. If the bullet needs to be crimped into place, the seater die will also perform this operation.

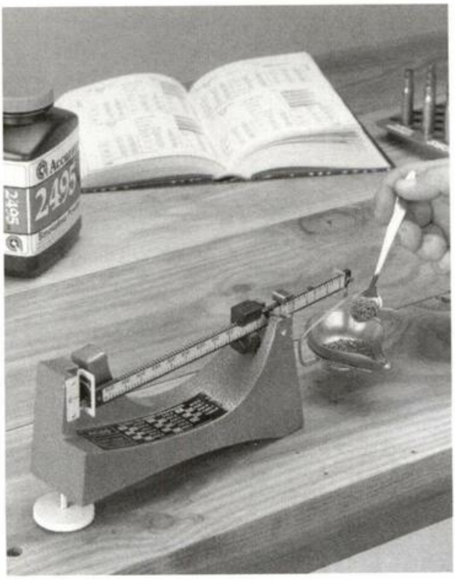
Die sets for straight-wall cases like the 45-70 or for most handgun cartridges have three dies. The sizing die returns the case to its proper dimensions except for the case mouth. The *expander die* brings the case mouth to proper size and flares the case slightly to make bullet seating easier. The seater die functions just like the seater in a bottleneck set with the option of crimping the case mouth if needed.

Like presses, die sets are available with a wide range of features. RCBS sells three lines of dies. Reloader Special™ dies are economically priced and come in fourteen popular rifle calibers. RCBS Precision dies are available in a wide selection of calibers and offer more flexible adjustments for special applications. RCBS Competition™ Dies are premium dies with special features developed in benchrest competition and include a precision-alignment bullet seater with a micrometer-type depth adjustment.

Reloading dies are the precision tools that can make your reloaded ammunition perform better that factory ammunition. They should be treated just as you would treat a fine firearm. Almost all common rifle/pistol dies are threaded with a 7/8-14 thread, which is the standard of the reloading industry. Larger die diameters up to 1-1/2 inch may be required in special applications like the 50 caliber BMG cartridge and some large English cartridges. If you plan to load one of these cartridges, see if your press has the ability to handle dies of larger diameter. Several RCBS presses can handle 1-1/4 and 1-1/2 inch dies by removing an adapter bushing.

- **Shell holder**— the shell holder attaches to the ram of the loading press to hold the rim of the cartridge, positioning the case in perfect alignment with the reloading die. RCBS shell holders are available in standard rim configurations for all popular cartridges. Many shell holders can be used for more than one cartridge so it isn't always necessary to buy a new shell holder when changing calibers. The data pages in this manual list the RCBS shell holder needed for each cartridge.

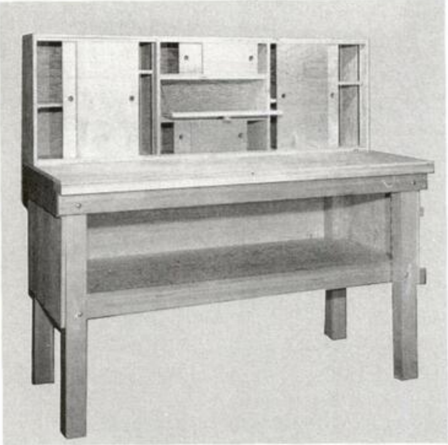
- **Powder scale**— a reliable and accurate scale is absolutely mandatory for safe reloading. A RELOADING SCALE MUST BE CALIBRATED IN GRAINS (NOT GRAMS OR OUNCES) and be accurate to ±0.1 grain. Reloading scales are furnished with a special pan to facilitate pouring powder into the case. To avoid any confusion, buy a scale produced by one of the reloading companies. Some novice reloaders have suffered accidents when trying to use a scale that was intended for another



Accurate powder measure is crucial to consistent and safe handloading. (RCBS 5-0-5 scale)

purpose. Read and fully understand the operating instructions for a reloading scale, especially those pertaining to the setting of the poises. Misreading the scale setting can cause accidents. RCBS markets five precision scales for the reloader, from the inexpensive Model 502 to the high-tech Electronic Scale.

• **Case lube and pad**— rifle cases must be lubricated before resizing. If not, they can stick in the die and stop the reloading process. A lube pad looks like an ink pad. When a case is rolled on the pad's porous surface, the proper amount of lubricant is applied. Case lube can be applied by hand, but given the low cost of a pad, why not make things easy on yourself? RCBS sells the Case Lube Kit that includes the lubricant and pad plus brushes for cleaning and lubricating the inside of the neck. RCBS Case Lube 2 is water soluble for easy clean-up. For ease of application, there is RCBS Case Slick™, a spray lubricant that permits very low sizing effort.



NRMA reloading bench design/plans available

• **Powder funnel**— although one of the least expensive items on your shopping list, a powder funnel will save a lot of time and aggravation when pouring powder from the scale pan to the cartridge case. Funnels designed especially for reloading are available from RCBS and other reloading manufacturers.

• **Loading block**— Another item, the loading block holds cases in rows for easier processing. Proper use of a loading block minimizes the chance of a double charge and prevents spilling powder. Loading blocks are available from RCBS and other manufacturers.

• **Press mounting**— Although there are some hand-held loading tools on the market, the bench press provides more power for full-length resizing and should be firmly mounted for safe and easy use. Clamping a press directly to a tabletop is generally not a satisfactory mounting technique. Clamps can work loose, allowing the press to move under pressure. Worse yet, a heavy press falling to the floor can injure your feet severely. A heavy workbench is best. It need not be elaborate, and lighter benches can be weighted with bullets or other heavy objects to steady them. The National Reloading Manufacturers Association (NRMA, 1 Centerpoint Drive, Suite 300, Lake Oswego, OR 97035) sells plans for an excellent, heavy-duty reloading bench.

RCBS offers the Accessory Base Plate that mounts to your bench and is pre-drilled to accept most RCBS presses and accessories. These heavy, metal plates allow quick changing of tools, and are especially useful where

RCBS Accessory Base Plate

bench top space is at a premium. If you don't use base plates, presses should be attached to the bench top with bolts. Large presses like the RCBS Rock Chucker® can be attached with 5/16 inch carriage bolts.

If a permanent setup is not possible due to space limitations, portable loading benches are a good alternative. Typically, they include a built-in seat, so the weight of the operator steadies the work station. Ready-made portable benches are available from several sources or you can build one from scrap lumber. Most designs can be folded or taken apart for storage in a closet or under a bed.

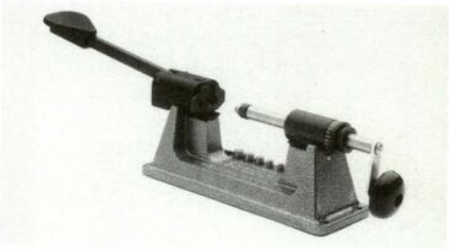
With this basic equipment you are ready to reload quality ammunition. However, there are other hardware items that can speed up the operation and add convenience:

- **Powder Measure**— a powder measure is designed to meter the same volume of propellant time after time, speeding up the loading operation. Measures are available in both fixed cavity and adjustable cavity designs. The RCBS Little Dandy® is a fixed-cavity design primarily intended for handgun use. Rotors for the Little Dandy come pre-drilled to provide a number of different volumes. Each measure comes with a chart showing the nominal powder charge for each rotor for a variety of popular propellants. To change the charge weight, a different rotor must be selected.

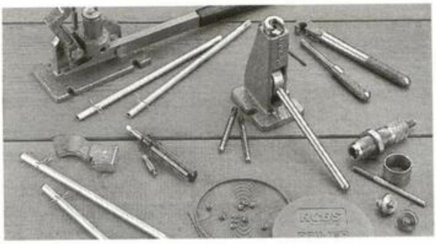
Adjustable-cavity powder measures are more versatile for the average reloader. The RCBS Uniflow® Powder Measure has an adjustable chamber in the rotor that will consistently meter most powders from small handgun charges to heavy charges of rifle propellants. No additional rotors are required. The repeatability of any powder measure is dependent on the type of propellant being used and the operating techniques used. Fine-grained ball powders meter with little or no variation in weight. Large-grained, cylindrical powders may meter less uniformly depending on the design of the metering cavity in the measure. The Uniflow measure uses a steel-on-steel surface contact and precision machining for smooth operation and long life expectancy.

AN ADJUSTABLE POWDER MEASURE MUST BE SET USING AN ACCURATE SCALE. The measure does not replace the scale; it just makes loading faster.

- **Case trimmer**— A case trimmer is a miniature lathe-like device used to accurately trim case mouths. Rifle cases, particularly those used with heavy loads, can stretch in length after several firings. Trimming the mouth reduces the case length to the proper dimension. Even new cases from the same lot can vary in length and many reloaders trim all new cases to begin with a consistent length. Rotary trimmers allow this operation to be performed quickly and accurately. Most trimmers have an adjustable stop so each case is trimmed to the same length. If you are shooting a high-capacity bottleneck case, consider buying a trimmer right away. These cases lengthen



RCBS Trim Pro case trimmer.

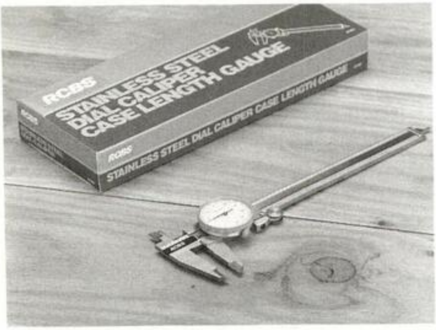


RCBS off-press priming tools.

quickly and, if the case mouth begins to enter the throat of the rifle, hard chambering and high pressure can result. When shooting a high-capacity case, the trimmer often becomes closer to a necessity than an option. The RCBS Trim Pro™ system can be upgraded to an electrically powered model with add-on options.

Cases can also be trimmed to length using a trim die. Install the trim die in the press and adjust it like a sizer die. Run a lubed case into the die—if it is too long the mouth will protrude above the top of the die. This excess is removed with a fine-cut file. The top surface of the die is hardened to prevent the file from damaging it.

- **Case length gauge**— A case length gauge tells you when trimming is necessary and helps you set the case trimmer. The same tool can also be used to measure the overall length of the loaded cartridge and to check bullet diameters. The most convenient case length tool is a caliper, either vernier or dial type. Calipers for case trimming should be calibrated in inches and be accurate to ±0.001 inch. RCBS markets the Stainless Steel Dial Caliper, a precision measuring device with a six-inch capacity.



RCBS
STAINLESS STEEL DIAL CALIPER CASE LENGTH GAUGE
STAINLESS STEEL DIAL CALIPER CASE LENGTH GAUGE

RCBS stainless steel dial caliper

- **Off-press priming**— Although you can prime cases on the reloading press, some reloaders choose to perform this operation on separate equipment. The reasons can vary from wanting a better "feel" of the primer entering the case to seeking a way to speed up the process. RCBS offers three off-press priming tools. The Standard Priming Tool inserts one primer at a time with low mechanical advantage for excellent feel. The Automatic Priming Tool features a tube that holds up to 100 primers and automatically places a new primer on the tool's priming post. A large number of cases can be primed quickly. The RCBS Hand Priming Tool, introduced in 1994, is a portable, hand-held unit with a primer feed tray that can be used almost anywhere you need to prime cases. It features an integral gate that separates the primer supply from the insertion operation, an important safety feature lacking in other similar tools.

Starting the Reloading Process

You've been down to the local gun shop and now have all the components and hardware you need to start loading for that favorite rifle. It's time to look at the steps that will produce your handloaded ammunition. Note that some steps are labelled "optional". Everything else is a "must-do" operation.

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— Step One —

Read the Instructions

It is vitally important that you read and understand the written instructions that come with each piece of reloading equipment. Failure to do this important step can cause damage to the equipment or your rifle, or worse yet, injury to the operator. If you are unsure of how to operate the equipment, seek help from your local reloading professional or call the equipment manufacturer. RCBS has a toll-free number for technical assistance on its products: 1-800-533-5000.

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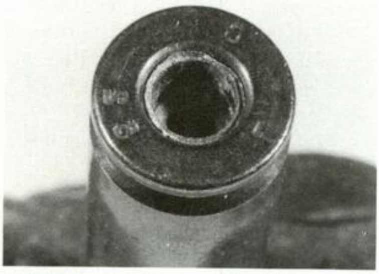
— Step Two —
Case Cleaning (optional)

As a reloader, you will discover that fired cases can get very dirty. In addition to powder and primer residues, the case can pick up residual oils left in the firearm. When the case falls to the ground, it picks up dirt. Cases can become stained or darken with age. Stains won't keep a cartridge from shooting accurately; however, most reloaders take pride in their hobby and usually want the product of their labors to look good. On the other hand, really dirty cases can damage loading dies and firearms and should be cleaned before proceeding. Another benefit is that clean cases are easier to inspect than dirty ones.

Cases can be cleaned in two ways — wet or dry. Wet cleaning involves giving the cases a bath. We recommend that cases be deprimed before wet cleaning to make thorough drying easier. RCBS offers a Universal Decapping Die to remove primers without performing any other operations on the case. If cases are washed with primers still in place, trapped moisture can cause corrosion in the pocket, resulting in decapping problems later.



Primer separation caused by failing to remove primer prior to case washing.

Washing can be as simple as placing the deprimed cases in a bucket and rinsing them with clear, hot water. Dirtier cases may require that soap be added. A small quantity of liquid dish washing soap will help speed cleaning. RCBS sells an excellent Liquid Case Cleaner that removes most stains and rinses cleanly.

For more aggressive washing and stain removal, the RCBS Sidewinder® Case Tumbler can be used for either wet or dry cleaning. Its large drum holds up to 150 30-06 cases and it comes with the Liquid Case Cleaner concentrate for effective case cleaning. Washed cases must be completely dry before reloading. Cases can be placed in the sun or on a stationary dryer rack available for many brands of clothes dryers. About 45 minutes with the dryer set on high heat will dry cases nicely. Cases should not be dried in a kitchen oven because, even at low settings, the temperature may reach levels that could weaken the cartridge brass.

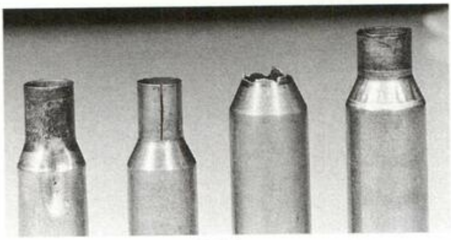
RCBS
SIDEWINDER
CASE TUMBLER

RCBS Sidewinder Case Tumbler

Dry cleaning of cases is accomplished by the action of mild polishing media being vibrated or tumbled against the cases. Vibratory cleaners consist of a large bowl

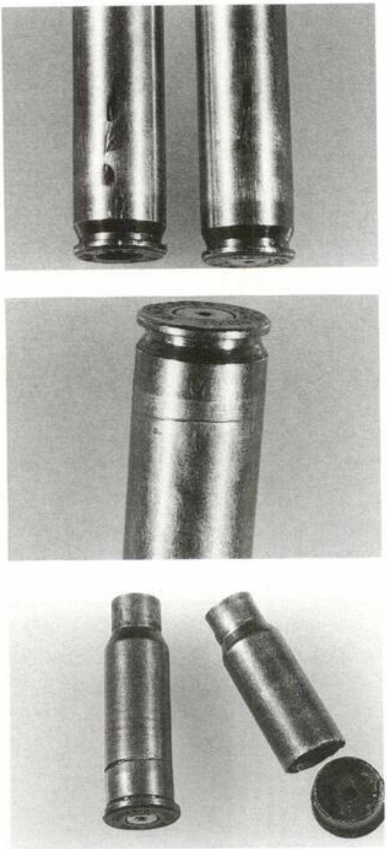
RCBS
VIBRATORY
CASE CLEANER

RCBS Vibratory Case Cleaner



Examples of case neck defects.

attached to a motor-driven vibrating base and are available from RCBS and other manufacturers. The cases and cleaning media are placed in the bowl and the unit is allowed to run for several hours. Vibratory case cleaners should not be used for wet cleaning. Tumbling of cases can be performed in the Sidewinder, which is designed for both wet and dry cleaning.



Examples of split cases

RCBS offers two different types of dry media for case cleaning. A ground walnut hull media with iron oxide polishing compound cleans heavily stained cases. A ground corn cob media impregnated with green chrome oxide is excellent for cleaning less dirty cases and gives a higher degree of polish.

Regardless of how you choose to clean cases, the time and effort expended will insure longer case and die life.

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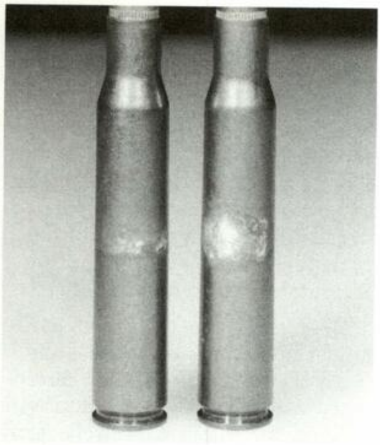
— Step Three —
Case Inspection

First, individually inspect the cases for obvious defects. If using military surplus cases, this is a good time to run a magnet through the cases to sort out any steel cases. If you are uncertain of the "pedigree" of the cases, make sure that they use Boxer—not Berdan—priming. Shine a strong light into the case mouth and look at the web area. Boxer-primed cases have a single, centered flash hole. Berdan-primed cases normally have two very small flash holes located on either side of center. Separate the Berdan cases; unless you have the special equipment to handle Berdan cases, you are better off to discard them.

Any cases with the following defects should be segregated or discarded:

- **Mixed calibers**— it is quite easy to get a 270 case mixed in with 30-06 cases since they are very similar in size. Having a case of the wrong caliber on the bench will disrupt the loading process at least, and could result in an unsafe cartridge if it were somehow reloaded.
- **Split case mouths.**
- **Cracks, splits or holes**—anywhere on the case.
- **Crushed cases**— even though some may look as if they can be salvaged, the damage may have caused internal weakening that won't show until the case is fired.
- **Pitted or corroded cases**— cases that have been stored in leather belt loops or exposed to a corrosive environment will be weakened and should not be reloaded.



Examples of corroded cases

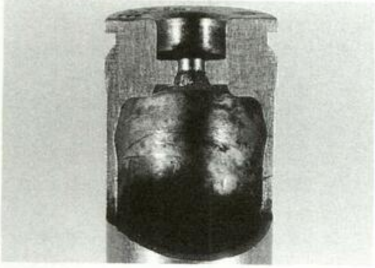


Fig. 1 Case thinning due to excessive sizing.

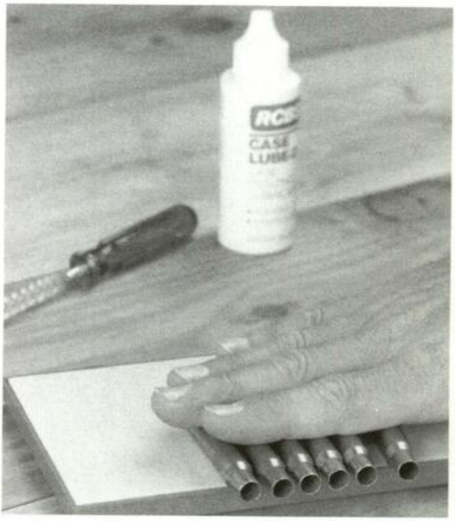
- **Excessive case bulges**— some bulging is normal in fired cases, but you will occasionally find case expansion that seems out of the ordinary. These cases should be discarded, since excessive bulging, especially just above the case head, indicates potential weakening of the case. When resized, the case may be too thin in this critical area and, when fired, cause a dangerous case failure (see Figure 1). Watch for narrow bright rings close to the web of the case. A certain amount of swelling is normal at this point. However, bright rings associated with normal expansion are generally wider than the narrow bands that indicate excessive stretching. Excessive headspace, excessive resizing and high pressure loads can cause cases to thin at this point. If unsure of the condition of a case, make a probe from a short length of stiff wire with the tip bent about 45 degrees and use it to feel the inside of the case above the web. Better yet, use the case probe on the RCBS CaseMaster™ to examine for thinning. A depressed ring felt inside the case indicates a possibility of failure. If this condition is detected in once-fired factory cases, you should have the rifle's headspace checked by a competent gunsmith. See the next chapter, "Advanced Techniques", for additional information.

- **Cases with damaged rims**— damaged rims can cause a case to stick in the shell holder or the cartridge may fail to chamber or extract properly in your rifle.

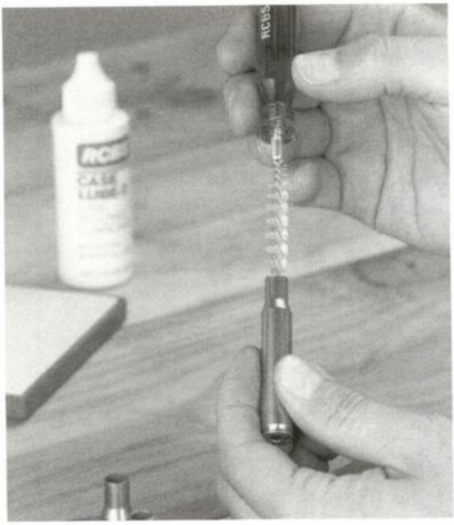
Refer to the photo examples shown here of common case defects. When you find a defective case, crush it with pliers to make sure it doesn't get mixed with the good cases and reloaded.

— Step Four —
Case Lubrication

Rifle cases must be lubricated before resizing to prevent sticking in the sizing die. For single-stage loading, use a case lube pad with a good reloading lubricant such as RCBS Case Lube-2 that is designed specifically for reloading. Other shop lubricants may not work properly under the heavy stress of sizing. Place about a half-teaspoon of lube on the pad and rub it in evenly over the surface of the pad. Allow a few minutes for the lube to soak in.



Use of RCBS Case Lube Pad and Case Lube 2.



Use of RCBS Neck Brush to lubricate case neck.

Place about five inspected cases on the pad and lightly roll them so each case has a thin film of lube completely around the body. Avoid getting lube on the shoulder or neck. Excess lube trapped at this point can cause hydraulic dents in the case shoulder.

The inside of the case neck can accumulate propellant residue that can make neck expansion and bullet seating more difficult. The inside of the case necks can be lubricated by either lightly dragging the open end of the case across the pad or by rolling a case neck brush on the pad and brushing the inside of the neck. Avoid excessive lube in the neck area. Too much lube can contaminate the propellant powder. Often, merely dry-brushing the necks is sufficient to let them pass easily over the expander ball.

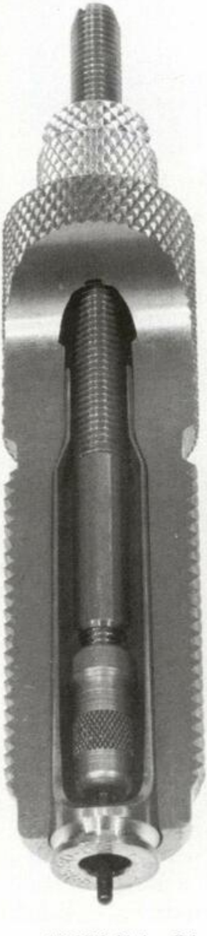
RCBS also offers Case Slick™, a spray-type lubricant that greatly reduces sizing forces, yet can be applied sparingly. A little Case Slick will go a long way.

— Step Five —

Full-length Case Sizing and Neck Expansion

Resizing returns the case to the proper dimensions to insure reliable functioning and assures that the case neck grips the bullet tightly. Sizing dies for bottleneck cartridges are designed to reduce the neck's internal diameter to slightly smaller than the bullet diameter. When the case is withdrawn from the die, an expander ball mounted on the expander rod is pulled through the case neck, setting the correct diameter for bullet seating. Proper installation and adjustment of the sizing die are critical for reloading accurate and safe ammunition.

To do this, place the proper shell holder in the ram of the press and screw the sizing die into the threaded hole in the top of the press. With the ram at the top of its stroke, turn the die until it touches the shell holder. Release the ram slightly and tighten the die one-quarter turn more, then bring the ram back up.



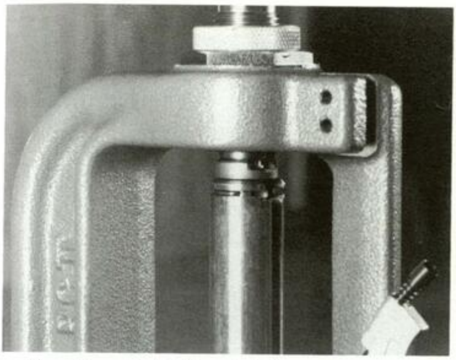
Cut-away of RCBS Sizing Die with a rifle case engaged.

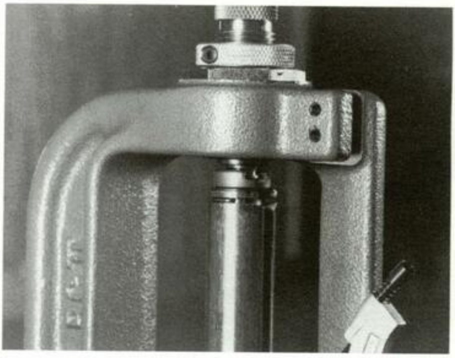
You should feel a slight springing when the ram is fully raised against the die. (Carbide sizing dies for handgun cartridges must be adjusted differently— see the section on loading handgun ammunition.) The die is now properly adjusted for full-length resizing. To prevent the setting from changing while reloading, screw the lock ring down until it touches the press body, and tighten the lock ring's set screw.

Remember that rimless, bottleneck cases headspace on the shoulder. With the proper die setting, the shoulder will not be pushed back past its original position. Pushing the shoulder beyond this point will create excessive headspace. Excessive headspace may degrade accuracy and can cause a case failure with potential for injuring the shooter. Modern dies and shell holders are pre-set to prevent this from happening. However, some people insist on modifying the die or shell holder, thus creating a dangerous condition. **NEVER** attempt to remove metal from either the sizing die or shell holder. For best results, use dies and shell holders from the same manufacturer.

Most sizing dies have a decapping pin which will eject the spent primer during the sizing operation. The pin should be adjusted so that it protrudes beyond the bottom of the sizing die about one-quarter inch.

Once the die is adjusted, place a lubricated case in the shell holder and lower the press handle. The leverage of the press will force the fired case into the die and perform the necessary dimensional changes. The fired primer will be ejected at the same time. As you raise the press handle to remove the case from the die, you will notice a slight resistance. This is the case neck passing over the expander ball and is normal for bottleneck cases. After fully lowering the ram, remove the case from the shell holder. Inspect the case to make sure it is free from dents or mouth damage. Set the case aside in a loading block and size the next lubed case. Before going on the next operation, remove the case lube from the cases. RCBS Case Lube 2 is water-soluble and can be easily removed with a damp cloth. Case Slick can be removed by tumbling the cases in cleaning media. Remove the sizing die from the press, wipe off any lube or debris and put it away.

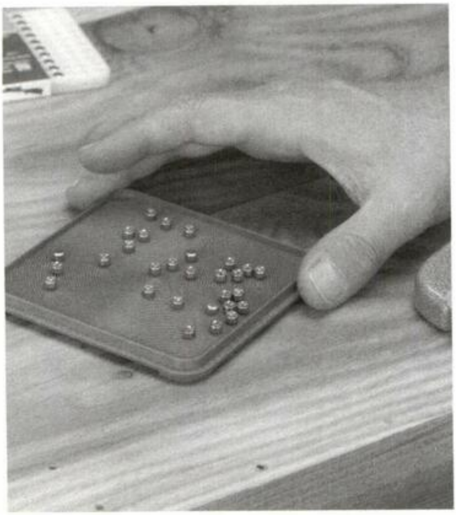

Sizer die set for full-length sizing.


Sizer die set for neck-sizing.

Straight Wall Cases—Neck Expansion

Sizing straight-wall rifle cases requires the same procedure noted above except that neck expansion is not performed in the sizer die. Neck expansion for these cases takes a separate step and an extra die that is furnished with the die set. Neck sizing also flares the case mouth in straight-wall cases.

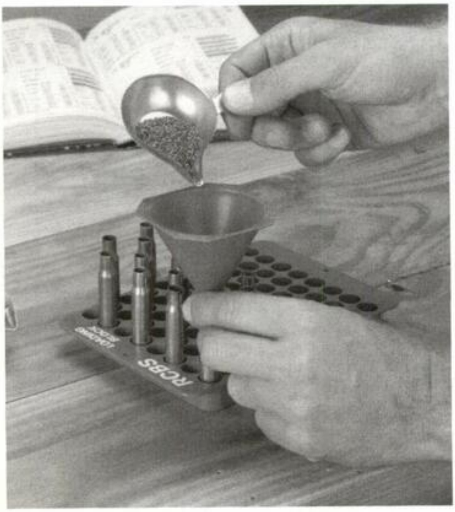
Lower the press handle and screw the expander die into the press until the die body touches the shell holder. Unscrew the expander plug until a sized case just touches the plug when the ram is fully raised. Lift the handle to lower the ram slightly and screw the plug down one-quarter turn at a time until you see that the case mouth is slightly flared. Avoid excessive flare to prevent premature mouth splits. Check the amount of flare with a bullet of the correct caliber to make sure there is just enough flare to keep the bullet from catching on the edge of the case, yet allow it to freely enter the case about one-sixteenth inch.



The Primer Tray is a useful tool to orient the primers in their proper position.

— Step Seven —
Priming

Before handling primers, make sure your hands are free of case lube and other oils. Lube on primers can cause misfires or erratic ignition.



Use a Loading Block for charging the cases.

How primers are inserted depends on the type of press you own. Some presses have an attached primer arm that swings under the shell holder. Others, like the RCBS Ammo Master single-stage, use a special ram priming device. Primers can also be seated in an off-press unit, either bench-mounted or hand-held.

Because methods of priming vary quite a bit with the type of equipment used, read the instructions for your reloading equipment before priming. Regardless of equipment make, there are several points that are the same:

- Primers must be fully seated. If seated too shallow, the firing pin blow is cushioned and misfires can occur. CCI primers provide optimum sensitivity when seated .003" to .005" below flush with the anvil legs in contact with the bottom of the pocket. With practice, you will soon recognize the "feel" of a properly seated primer as it enters the pocket.
- Use a slow, even pressure to seat primers. Never use a sharp blow. If you meet unexpected resistance, stop! Remove the case from the shell holder and determine the cause of the problem before proceeding.
- Military surplus cases usually have a crimped-in primer. Before repriming them, be sure that the original crimp is completely removed. The RCBS Primer Pocket Swaging Combo reforms the military primer pocket to one with a smooth, commercial type profile.
- Almost all priming devices have a spring-loaded sleeve around the punch to hold the primer. Make certain before priming that the proper size sleeve and punch are installed. Older reloading equipment may have a cup-shaped primer punch. This type of punch is intended for an obsolete style of primer with a domed base. Unless you have a supply of these older primers, make sure a flat primer punch is installed.

- Cases that have been fired several times will have a build-up of primer residue in the bottom of the primer pocket. Excessive residue can make the new primer difficult to seat. This can be quickly removed with an RCBS Primer Pocket Brush of the appropriate size.

IMPORTANT
Safety Reminder

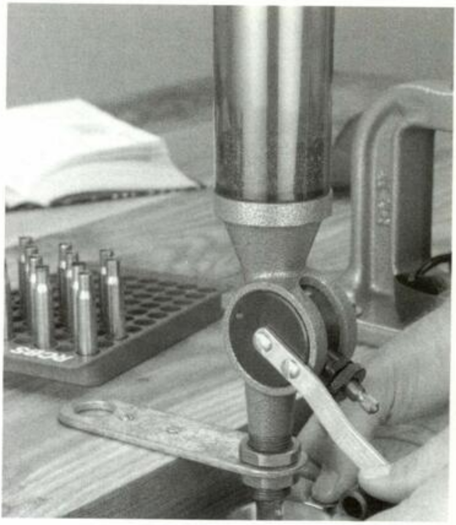
If you discover a high primer after the cartridge is fully loaded, DO NOT ATTEMPT TO RESEAT IT. There is only one safe way to deal with this: pull the bullet and remove the powder. Then, and ONLY then is it safe to reseat the primer.

— Step Eight —
Charging the Case with Propellant

Although an easy operation, proper powder charging is critical to safe reloading. NEVER attempt to guess at the correct powder charge. Refer to the reloading data furnished by a reputable bullet, powder or reloading equipment supplier. The data contained in this manual were developed under laboratory conditions. Most standard cartridges were fired in industry pressure testing equipment and conform to established pressure limits.

Do not load to maximum listed levels without starting lower and working the load up in your rifle. Chances are that you will find an accurate load before reaching the maximum.

Powder charging must be done only with a reliable and accurate reloading scale. Place the cases to be charged into a loading block. Weigh the desired amount of propellant on the scale and transfer it to the first case using a powder funnel. Repeat until all the cases are charged. Before seating bullets, shine a flashlight in each case in the loading block to insure that desired powder charge is present in each case. All cases should appear to have the same level of propellant. If in doubt about a charge, pour the powder back into the scale pan and verify the weight. IT IS IMPORTANT TO CHARGE AND INSPECT ALL CASES BEFORE SEATING BULLETS.

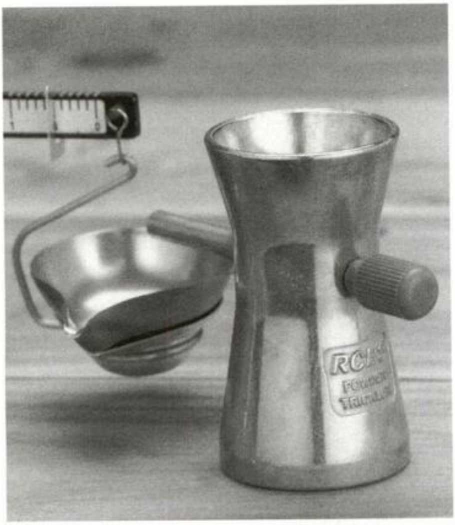


Use of an RCBS Uniflow Powder Measure for faster charging of cases.

To speed up the charging process after a load has been carefully developed, many reloaders choose to use a powder measure. Most quality measures will meter charges almost as consistently as you can weigh them. All factory ammunition is metered and still yields remarkable charge-to-charge uniformity. Because a powder measure works by volume, it is mandatory that you use a reloading scale to set the measure's adjustable drum to throw the desired weight of propellant.

Place the scale pan under the powder measure and operate the handle. Weigh the powder charge and adjust the measure until you reach the proper charge weight. Meter several additional charges to settle the powder in the measure and then recheck the weight. Remember that the meter must be reset when you change powder types. A charge of 50 grains of H4831 will not occupy the same volume as a charge of 50 grains of Winchester 760.

With primed cases in the loading block, pick up a case and place the



RCBS Powder Trickler for fine-tuning charges.

mouth in contact with the measure's drop tube. Operate the measure handle, allowing at least a second or two for large charges to fully flow into the case. Operating the handle too fast can cause light charges if the powder hasn't finished flowing before you cycle the handle again.

After charging the first case, return it to the loading block at the opposite end from the uncharged cases or, better yet, place the charged case in a second block. Pick up the next empty case and repeat the sequence. Developing a consistent stroke when operating the handle will insure uniform charge weights. After charging about 10 cases, remove one at random and pour the powder back into the scale pan to verify the weight. Continue until all cases are charged.

MAXIMUM LOADS SHOULD ALWAYS BE WEIGHED. You can use a modified procedure combining both metering and weighing which is not as slow as using the scale alone. For maximum loads, set the measure to meter about 0.5 grains under the desired load. Throw the charge into the scale pan and put the pan on the scale. Use an RCBS Powder Trickler or a small spoon to add a few kernels of powder at a time until the scale shows you have reached the desired charge weight. By using this technique, each charge is individually weighed but the charging is much faster than by using the scale alone.

As with any powder charging operation, look into every case before seating bullets. Some reloaders have developed the habit of metering a charge into one case and then seating the bullet before going to the next case. THIS TECHNIQUE IS NOT SATISFACTORY BECAUSE IT IS POSSIBLE TO INCORRECTLY CHARGE AND SEAT A BULLET WITHOUT KNOWING A PROBLEM EXISTS. Inspecting all the charged cases in a loading block *before* seating the bullets insures that all charges are uniform and correct.

When using a powder charge that does not fill the case, take extra time in the inspection stage to look for double charges. A strong light source like a pen light will make inspection easier. A double charge of a fast-burning powder can destroy a fine rifle and injure the shooter or bystanders.

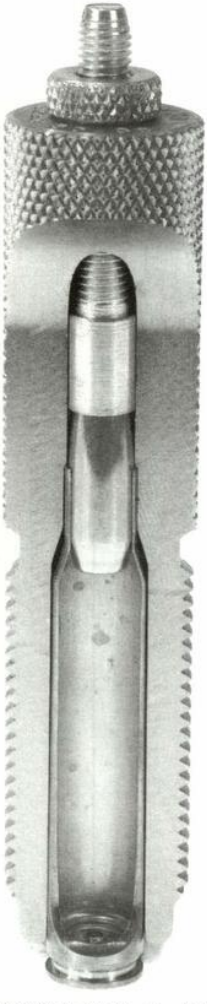
Compressed Powder Charges

Certain combinations of powder and cases may result in the powder charge being compressed when the bullet is seated. This is normal with small, high-pressure cartridges like the 308 Winchester, and with many of the large magnum cases when slow-burning powders are loaded. Compressed loads in this manual are indicated with the letter "C" next to the charge weight.

The new reloader often wonders how he can get so much powder in a case. Slight modifications to the charging technique will help you accomplish this task with minimum effort. Usually, pouring the charge into the upper portion of the funnel slowly will give enough room to start the bullet into the case. Tip the funnel slightly to one side while pouring. This causes the powder to spiral down the funnel, allowing several seconds for the charge to settle. You can also facilitate loading compressed charges by adding a six inch length of copper or aluminum tubing to the bottom of your powder funnel. Flare one end to cover the case mouth. This is called a *long drop tube* and, like slow pouring, allows more time for the charge to settle during pouring.

Using a slow, even pressure on the press handle when seating bullets on compressed charges will prevent damage to the case or bullet.

Using compressed charges of fine-grained powders with a boat tail bullet can create problems. A few of the granules can wedge between the tapered bullet heel and the case neck, creating a tiny bulge. In some rifles, this bulge can prevent a cartridge from chambering.



Cut-away of RCBS Bullet Seating Die with a bullet and case engaged.

— Step Nine —
Bullet Seating

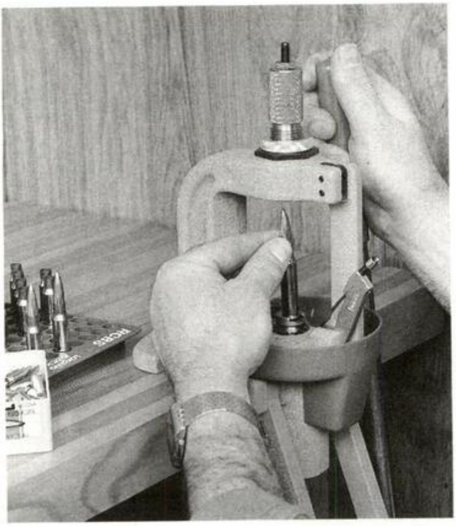
Before seating a bullet, you need to determine the proper seating depth. The loads listed in this manual show the cartridge overall length (C.O.L.) used by Speer for load development. In many cases, this is under the maximum SAAMI cartridge length specified in industry standards.

Although the SAAMI maximum C.O.L. should function properly in the factory rifle having the shortest action, a custom rifle may require a different length. Your rifle's throat will also affect the C.O.L. One rifle may have less freebore in the throat than another. Magazine length can also affect the required cartridge length. The bullet itself is also a factor. The ogive (the curvature of the bullet nose) will vary between styles of bullets, thus affecting where the bullets contact the rifling.

For reliable function, ammunition for semi-automatic, slide-action and lever-action rifles should be loaded close to factory dimensions. Rifles with tubular magazines are often the most sensitive to cartridge length. Bullets intended for tubular magazine rifles have a crimping cannelure that sets the proper length for that cartridge. C.O.L. for a falling block single-shot rifle such as the Ruger No. 1 or the Browning model 1885 is not so critical, and need only to clear the rifling.

Often, best accuracy is obtained when the bullet just clears the rifling in the chamber throat. HOWEVER, UNDER NO CONDITION SHOULD A JACKETED BULLET BE ALLOWED TO CONTACT THE RIFLING BEFORE FIRING. This condition can cause high pressures in an otherwise safe load.

To seat a bullet, place an empty case of the correct length in the shell holder and raise the ram fully. Screw the seater die into the press until you feel a slight resistance. The case mouth is now touching the crimp shoulder in the die. Back the die out one turn and tighten the

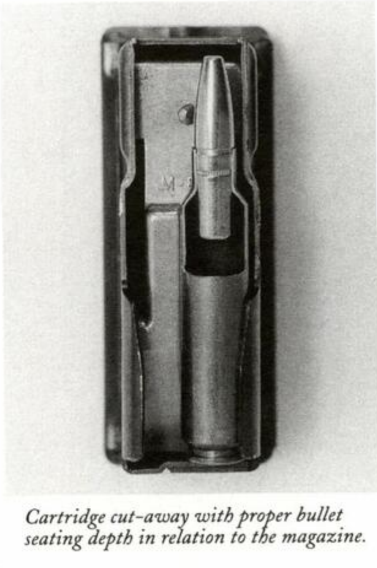


Bullet seating on a single-stage press.

lock ring. Loosen the lock nut on the seating stem and unscrew the stem as far as possible. Remove the empty case. Place a bullet on the mouth of a charged case and support it between your thumb and forefinger. Insert the case head into the shell holder and raise the ram. As the case neck enters the die, let go of the case and give the press handle a full stroke. Slight resistance means the bullet has started into the case. If the bullet has not started to seat, screw the seating stem in and repeat the steps until you feel the bullet start to seat. Lower the ram and compare the cartridge length with a factory round or measure it with a caliper. If the bullet needs to go deeper, screw in the stem and repeat. Continue until the proper C.O.L. is obtained. Securing the lock nut on the seating stem will preserve the C.O.L. setting.

Sometimes, a factory cartridge or published loading length is not available. A good way to determine proper seating depth for your rifle is to make a dummy round (no primer or powder) with the bullet you plan to use. Start a bullet into the sized case but leave it long. Try gently chambering the dummy round in your rifle. If you feel resistance, remove the dummy round and screw the seater stem in one full turn and seat the bullet deeper. Try the round again in your rifle. As soon as the action can fully close with only a slight effort, remove the cartridge and rub a dark-colored "whiteboard" marker over the bullet or soot the bullet with a match (dummy rounds only!). Chamber the round and see if the ink or soot has rubbed off at evenly spaced points. If so, this shows that the origin of the rifling is contacting the bullet and the bullet needs to be seated slightly deeper. Usually, one more full turn of the stem will position the bullet off the rifling yet be close enough for excellent accuracy. Once it is properly seated, keep this dummy round with your loading dies as a gauge for quickly setting your dies in the future. Mark it to show the bullet weight and style, along with the gun identification if you have more than one rifle chambered for that cartridge (different rifles can have different chamber throat dimensions although chambered for the same cartridge).

By popular request, we have included the C.O.L. we used for testing each load. This information was not included in previous editions of the Speer Reloading Manual. This LENGTH IS PRESENTED AS A GENERAL GUIDELINE; IT MAY NOT BE RIGHT FOR YOUR RIFLE. Using the above technique will point the way to the correct C.O.L for your firearms.



Cartridge cut-away with proper bullet seating depth in relation to the magazine.

The RCBS Precision Mic can also be used to set the seater die. Refer to the instruction sheet for details.

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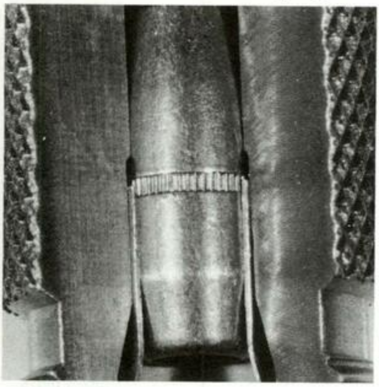
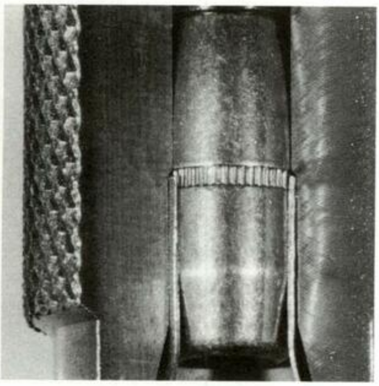
— Step Ten —
Crimping (Optional)

For certain applications, it may be necessary to crimp the bullet after seating. Crimping rolls the edge of the case mouth into a crimping cannelure (groove) to secure the bullet. Crimping is not needed for every cartridge or firearm. Bullets to be crimped MUST have a crimping groove. The groove provides the needed clearance to allow the crimp to form properly without damaging the bullet. Crimping an uncannelured bullet deforms the jacket, and poor accuracy can result. Any gains in ballistic uniformity are meaningless if the load is not accurate.



Seating Die cut-away set for no crimp.



Seating Die cut-away set for crimping.

Crimping is recommended for the following applications:

- Ammunition intended for semiautomatic rifles, particularly the military-style firearms.
- Ammunition for rifles with tubular magazines. With the cartridges stacked end-to-end, recoil causes compressive force on the bullets. If not crimped, the bullets may be pushed into the cases, causing malfunctions and possibly raising pressures.
- Ammunition for magazine rifles that produce very heavy recoil. Depending on the design of the magazine, the bullets can unseat when the rifle recoils, making the cartridge too long to chamber. As you can imagine, this is a very hazardous condition when hunting dangerous game!

Most seater dies have the capability to crimp bullets (RCBS Competition seater dies are designed for target ammunition and therefore don't apply a crimp). Crimping is accomplished by a small shoulder in the neck area of the die. To set the die for crimping, seat a cannelured bullet as described above, making sure that the top of the bullet's crimping cannelure is just above the case mouth. Then unscrew the seating stem as far as possible and loosen the lock ring on the die body if it has been previously set. With the cartridge in the shell holder and the ram up, screw the die body in until you feel it touch the case. Lower the ram slightly and screw in the die one-half turn. Slowly raise the ram again. The crimp shoulder will fold the case mouth into the cannelure.

Inspect the cartridge. If more crimp is needed, screw in the die body a quarter-turn at a time until you are satisfied with the crimp. When the crimp is sufficient, set the lock ring on the die body. Be sure not to over-crimp.

If you wish to seat and crimp at the same time, replace the cartridge in the press and raise the ram fully. Screw in the seater stem until it stops, and secure the lock nut. The die is now correctly set to seat the bullet and apply the desired amount of crimp. Seat bullets as before; the crimp is formed just as the bullet finishes seating. Cases trimmed to uniform length will allow the most uniform crimps. Use care— excessive crimp will bulge the case neck and shoulder. A cartridge with a bulged neck will probably not chamber.

Cartridge cases with very thin case mouths (e.g., 32-20 Winchester) may be difficult to crimp without bulging. If this is the case, crimp in a separate operation. Seat bullets in all the cases, then raise the seater stem fully. Set the crimp as before, but do not lower the seating stem after the crimp is set.

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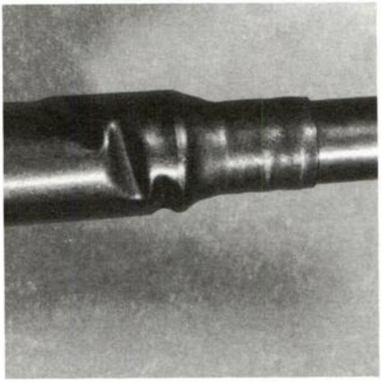
— Step Eleven — Inspection

Now you have finished cartridges ready for firing. There is one more step your need to perform before boxing up the ammunition— inspection of your work.



Damaged case— bulged neck.

Lay the cartridges on a light colored cloth or towel and look them over while rolling them with your hand. Check for:

- consistent bullet seating depth
- damaged case mouths
- high primers
- bulged necks
- damaged bullets, especially on the tip
- missing crimps if you planned to crimp

As you box the ammunition, run your finger across the case head to check once more for high primers. REMEMBER THAT YOU MUST NEVER ATTEMPT TO RE-SEAT A HIGH PRIMER IN A LOADED CARTRIDGE. Set cartridges with high primers aside for later disassembly.

Hunting ammunition should be checked to see if it will easily chamber in the rifle you plan to use. HOWEVER, YOU MUST FOLLOW CERTAIN SAFETY PROCEDURES. If your rifle has a safety that locks the firing pin, but still allows the bolt to operate, it is safe to test the ammo for proper chambering. If your rifle does not permit this, DO NOT attempt to chamber live ammo in the shop unless you disassemble the bolt and remove the firing pin and its spring. If you cannot disassemble the firing mechanism, try the ammunition only at an approved shooting facility with the muzzle held downrange. Inspection and testing of your handloads before the big hunt can save you much disappointment, frustration and missed game.

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— The Final Step — Proper Identification

After the ammo is boxed, completely record the exact loading information including the date on a label and attach it to the box. Speer bullets come packed with stick-on labels for this purpose. If you are keeping a logbook, this is a good time to bring it up to date. Proper identification of loads is an important step in safe reloading and can prevent dismantling ammo because you forgot how it was loaded.

You've now Loaded Your Own Ammo!

The twelve steps listed above sound lengthy when reading them but you will find that as your experience increases that reloading is neither complicated nor time-consuming. The text is written so that the beginning reloader can fully understand the operations but, hopefully, some of you experienced reloaders will pick up a few pointers, too. Now it's time to shoot those custom loads.

AT THE RANGE

The proof of quality handloads is whether they shoot well. Range testing for accuracy is needed to assess the loads, making sure that they meet the requirements for your sport.

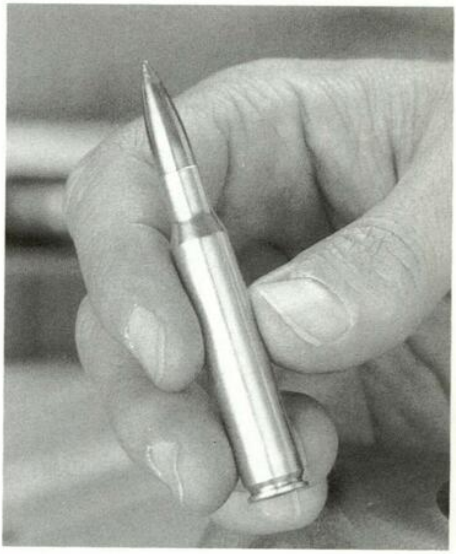
Safety at the Range

Always wear safety glasses to protect your eyes from flying particles. Wear approved hearing protectors to prevent hearing loss. Make sure of your backstop. Understand and follow all of the commandments of gun safety!

Getting Started

A good system for working up a load is to begin with the starting (minimum) load shown in the Speer Manual and load seven to ten rounds. Without changing the seater die settings, increase the charge in the next set of cartridges by one-half to one grain, depending on the size of the case. Repeat this loading process until you reach the maximum load listed. Mark each sample with the powder weight used and place them in separate boxes or, better yet, use a marker to code each group by coloring the primers (just remember to record your color code system!).

A single five-shot group is seldom adequate to give you an accurate picture of the quality of your ammunition. Even though a load produces a five-shot group of 0.75 inches, you don't know if the next group will be 0.55 inches or 1.75 inches. For best statistical confidence, five groups of five shots each is considered minimum. However, the cost of components mounts up quickly. A statistical analysis performed by Dr. Brent Banister, statistician for the CCI-Speer Quality Assurance Section, showed that a seven-shot group gave the highest degree of confidence with the fewest shots.



The finished cartridge is now ready for firing.

At the range, start with the lowest charge weight and shoot one seven-shot group or two five shot groups. You are looking for the load that gives the smallest group size—not the one closest to the bull! Once an accurate load is developed, it is easy to adjust the sights to correct for point of impact.

Fire each group on a separate target. After completing the series, compare the group sizes to determine which powder charge gave the best accuracy in your rifle. If you encounter any pressure signs while shooting a particular load, STOP! Don't shoot the next higher increment. For whatever reason, your rifle has reached its own maximum. The loads shown in this manual are tested against U.S. industry standards for pressure and were also fired in commercially available rifles. However, a foreign model or a custom rifle may not have a standard chamber and require a lighter charge.

From these tests, you should be able to find an accurate load. If no groups in the series meet your needs, the next thing is to adjust the bullet seating depth. If that doesn't improve accuracy, then try a different powder, repeating the process until you are satisfied that you have found the "right" load.

Eventually, you will find a combination of components that will give the accuracy and performance you seek.

Accuracy of Ammunition

New reloaders often ask, "What kind of accuracy should I get?" Well, this is a difficult question to answer. There are many variables: barrel condition, loading techniques, shooter's skill and weather to mention a few. Shooters commonly find their handloads show a noticeable improvement over factory ammunition.

In a factory, sporter-weight rifle with typical hunting bullets, 100 yard groups less than one and a half inch are typical with good handloads. This accuracy is quite adequate for most large game at normal ranges. Heavy varmint rifles with hollow point bullets will commonly shoot groups between one-half and one inch. With the right combination of rifle, components and shooting technique, even smaller groups are quite common.

Shooters' Tips for Effective Testing at the Range

- Use a bench that allows you to sit comfortably. Many ranges have benches; if they don't, portable bench kits can be purchased from several shooter supply companies or you can build one yourself. Kits and plans are advertised in most of the popular shooting magazines.

- Support the rifle firmly on sandbags or a shooting rest such as the Outers Varminter® Rifle Rest. If you use a rest, support the fore-end—not the barrel. For minor elevation adjustments, a sandbag under the buttstock can be squeezed with your non-shooting hand. Proper support removes much of the human factor and lets you shoot longer since you are more comfortable.

- Don't get kicked! Heavy-caliber rifles can be painful when shot on the bench. Several firms offer recoil absorbing pads that slip over your shirt or jacket. The pads absorb and distribute the recoil over a broader area. You can shoot better and longer if you aren't being abused by the rifle. When you become fatigued, groups will suffer. Wearing an extra recoil pad doesn't make you look like a novice; it simply indicates that you're more interested in serious shooting than in trying to impress someone!

- Position the rifle consistently for each shot. Pull the rifle firmly into your shoulder. Varying your grip may change group sizes in some rifles.

- Press the trigger consistently. Pace your breathing so you can hold your breath just before each shot.

- Pace your shots and shoot slowly. Rapid firing heats up barrels, resulting in unpredictable groups.

- Don't rush the shooting session or try to do too much in one session. Plan your shooting sessions so that you can work at a leisurely rate.

- Have fun!

CHAPTER 8

FINE-TUNING THE RELOADING PROCESS

[Advanced Techniques from the Experts' Notebooks]

This chapter covers some advanced techniques for accuracy improvement and more efficient reloading. These tips have been gathered from the years of reloading experience at Speer and from the input of involved shooters who were willing to share their knowledge with us.

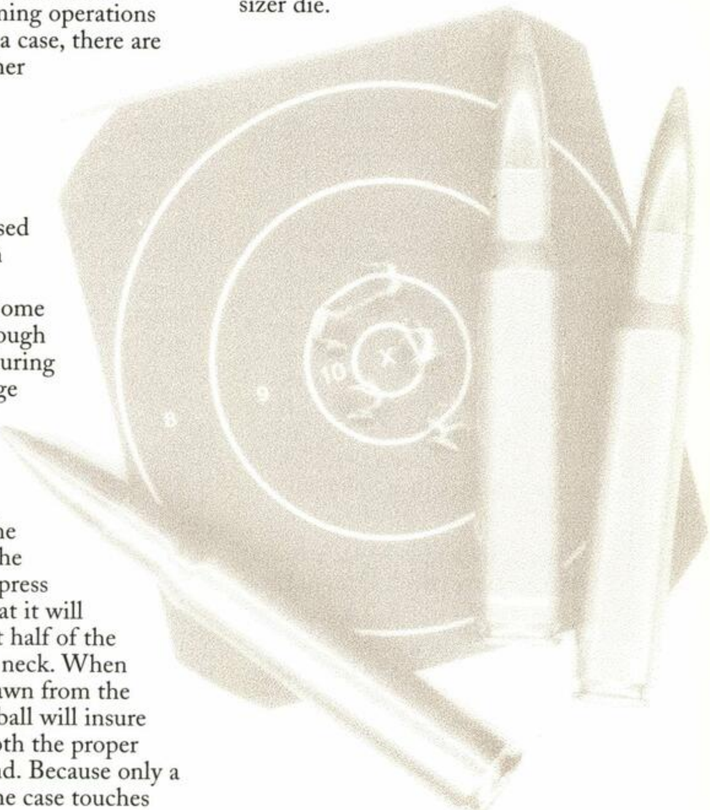
Loading New Cases

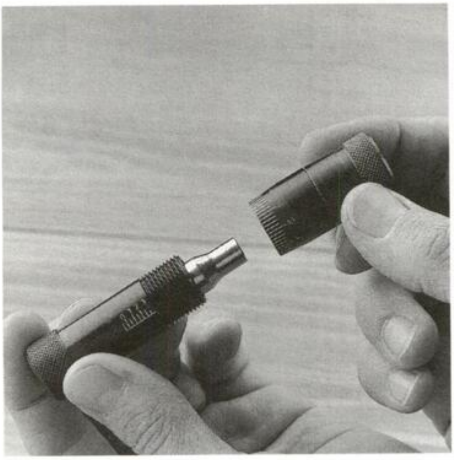
In recent years, the availability of new, unprimed cases has increased and the reloader can buy in bulk quantities with substantial savings. Even though the loading techniques other than resizing are essentially the same, a few simple steps can make loading new brass easier.

When the case manufacturer completes all forming operations required to make a case, there are lubricants and other manufacturing residues present which must be removed before shipping. The normal method used is tumbling which can dent the case mouths slightly. Some dents are deep enough to catch a bullet during seating and damage the case.

When starting with new bottleneck cases, condition the necks by placing the sizing die in your press and adjust it so that it will only contact about half of the length of the case neck. When the case is withdrawn from the die, the expander ball will insure that the neck is both the proper diameter and round. Because only a small portion of the case touches the die, lubrication is seldom required and it can be done quickly. If you find a case with a severe mouth dent, you may need to straighten it manually with a wooden dowel before running it into the die.

For straight-wall cases, whether rifle or handgun, usually running the case into the expander die set for normal flaring will insure round case mouths. However, check to see if the case neck tension is sufficient to hold the bullet you plan to load. If not, you will need to size the new cases before flaring. If sizing is needed, running the case about halfway into the die usually is enough. Straight cases should be lubricated unless you have a carbide sizer die.





RCBS Precision Mic

With the case mouths now uniformly round, this is a good time to check the case length. You will probably find that the length varies. If you have a Rotary Case Trimmer, set it to the trim-to length for the cartridge and trim all the cases. This assures a consistent length that can improve accuracy and, if you need to crimp, makes uniform crimping much easier. Remember to use a deburring tool on the case mouths after trimming to give a finished edge inside and out. Deburring will make bullet seating easier, and should be performed on all new cases, even if no trimming is required.

While you have everything set up for neck conditioning and trimming, you should go ahead and perform this operation on all the cartridges in the group. Let's say you ordered 500 cases. Go ahead and invest the time to trim all the cases to the same dimensions. Even though you don't plan to load all of them right now, the remainder can be stored. This way, every case within the batch is uniform.

Resizing for Maximum Accuracy and Case Life

Almost all bottleneck cases headspace on the case shoulder. When fired, the shoulder can change its position relative to the base of the case as the pressure of burning propellants expands the case to fill the chamber.

Sizing dies for each cartridge are designed to push the shoulder back to the minimum dimension specified by SAAMI. This insures that the reloaded ammunition will fit any standard factory chamber. However, it is possible to have a rifle with a "long" chamber. Cases fired in this rifle will have the shoulder pushed back too much if the dies are set in the normal manner described in Chapter 7. Cases that fit the chamber closely will be more accurate than those with a loose fit. Another advantage to fitting the fired case to your chamber is that cases will last longer if the shoulder is not constantly pushed back during every sizing operation.

For precise measurement of the relative headspace of your rifle, RCBS offers a device called the Precision Mic. These tools are calibrated for the industry base-to-shoulder length of many standard rifle cartridges. A "zero" reading in the gauge is the minimum length for that particular cartridge. To use the tool, place a factory round or a new, unfired case in the gauge and screw the thimble down until it lightly touches the case. Record this reading and then take a case that has been fired in your rifle and gauge it in the same manner. Compare the two readings. If the new case reading is 0.002" and the fired case reading is 0.008", then the case shoulder moved forward 0.006". If resizing returns the shoulder to its original position, the case will again stretch enough to fill the chamber on the next firing, thus reducing the life of the case. Instead, you can use the Precision Mic reading to set the sizer die to move the shoulder back only 0.002 inches to get a custom fit for that rifle.

This technique is best suited to target loads in bolt action and single shot rifles. A case sized in this manner will fill the chamber better and last longer, often giving better accuracy. For hunting ammunition where reliable function is vitally important, this method of fitting the case to the chamber might cause problems. If dirt or other foreign material gets into the chamber, a tight-fitting case may fail to fully chamber and cause a jam.

Cases for semi-automatic, pump action and lever action rifles should always be full-length resized for reliable function.

Sizing Belted Cases

The belted, bottleneck case has become synonymous with the word "magnum". The original purpose of the belt was to provide positive headspace control on cartridges like the 300 and 375 H&H Magnums that have very little shoulder. Modern belted magnums like the 7mm Remington Magnum and the 300 Winchester have adequate shoulders for headspace control so the belt is actually more a cosmetic feature than a design necessity.

To get top accuracy from your belted magnum, use the method described above to assure that the case headspaces on its shoulder instead of the belt. Many rifles will also show an accuracy improvement when this technique is used, and the cases will last longer.

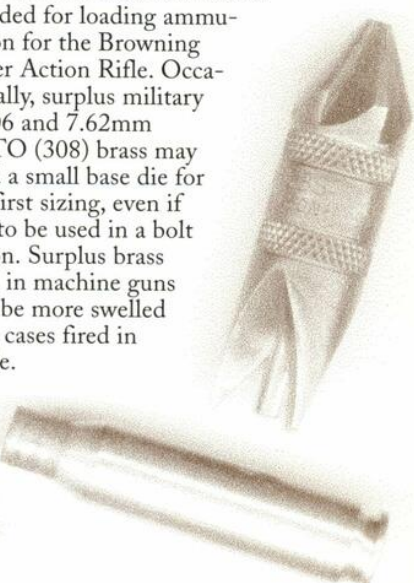
Flash Hole Conditioning

Most modern cartridge cases have flash holes that are pierced into the case, not drilled. Excess metal can be pushed up around the inside edge of the hole. On medium and large volume cases, the presence of this burr usually has little effect on hunting ammunition. However, for critical applications like match or varmint ammunition or in small cases like the 222 Remington, an uneven burr can cause inconsistent flow of primer gases from case to case.

To provide a uniform flash hole, you can trim the burr away with the RCBS Flash Hole Deburring tool. This tool enters the flash hole and trims the burr away, leaving a beveled edge around the flash hole. The RCBS unit has a caliber-specific pilot that aligns with the neck and centers the trimmer in the case without the need to "fish" for the flash hole. The pilot also features a positive stop so that all cases are uniformly trimmed. Pilots are available in popular sizes from 22 through 45 caliber.

Loading for Semi-Auto and Pump Action Rifles

Rifle cartridges originally designed for bolt-action or single-shot rifles are often used in semi-automatic and pump action rifles. Because the semi-auto and pump-actions do not have the mechanical leverage of a manually operated bolt-action, cases sometimes must be sized to a smaller diameter to permit reliable chambering and extraction. The critical area is the base of the case just above the extraction cannelure. RCBS offers Small Base sizing dies (as both complete sets and as a sizer die only) which are designed to reduce the base of the case slightly more than a standard sizer die. Full-length resizing is recommended for any reloaded ammunition used in semi-automatic and pump action rifles. Small base dies are also recommended for loading ammunition for the Browning Lever Action Rifle. Occasionally, surplus military 30-06 and 7.62mm NATO (308) brass may need a small base die for the first sizing, even if it is to be used in a bolt action. Surplus brass fired in machine guns may be more swelled than cases fired in a rifle.



Standard dies for cartridges such as the 7.62x39mm and the 30 Carbine that were originally designed for semi-auto rifles are already the small base design, so no special dies are normally required for resizing.

Chapter 10, "Troubleshooting", has additional information about loading for semi-automatic rifles.

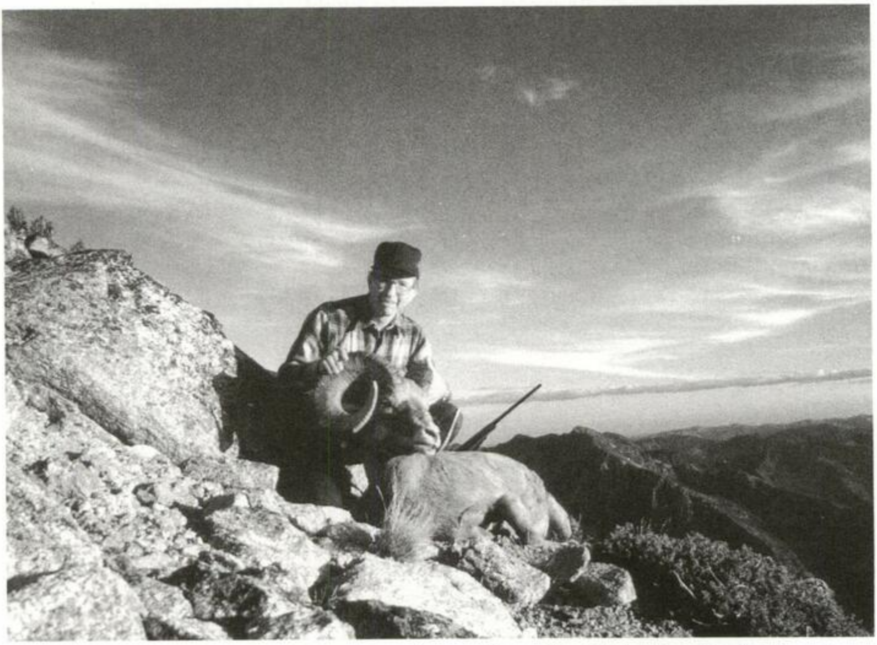
Trim Gauges for Rotary Case Trimmers

Once you have determined the proper trim length for a cartridge, you can preserve the measurement for quick resetting with the RCBS Trim Gauge. Offered in six sizes to cover most popular cartridges, trim gauges fit the RCBS Rotary Case Trimmer, as well as most other trimmers that have a half-inch shaft diameter. After setting the trimmer to proper length, snap the Trim Gauge over the shaft and adjust the set screw on the gauge. Once set, the gauge for that cartridge can be kept in the die box and used to quickly return the trimmer to the original setting. Merely snap the adjusted gauge over the shaft and the trimmer will repeat the required dimension time after time.

Case Neck Turning

Die manufacturers take great pains to insure that the neck portion of the sizing die is concentric with the body. However, no die can correct an out-of-round condition due to the case itself. Although most modern cases are manufactured to tight tolerances, you may occasionally find a case lot where neck wall thickness varies from one side of the case to another. Large capacity, small caliber cases fired with high pressure loads can exhibit neck thickening as the brass flows forward due to gas flow and pressure. An out-of-round condition can be detected with a special tubing micrometer. Case neck turning returns the neck to uniform wall thickness.

Turning can be accomplished with separate tools furnished by specialty shops, or owners of the RCBS Rotary Case Trimmer or Trim Pro™ can buy the Case Neck Turner Kit from RCBS. This accessory attaches to the RCBS trimmers and turns the inside and outside of the neck simultaneously. An automatic feed mechanism



Don Andersen, CCI/Speer Purchasing Agent, sits atop the world with his full curl Rocky Mountain Bighorn Sheep. (.270 caliber, 150 gr. Grand Slam) advances the cutter at a constant rate for clean and even cutting.

By setting the adjustable cutter to lightly contact the highest point of the case neck, any variation in the thickness should be readily apparent. Heavy cuts should not be attempted, as this can force the cutter to run off-center and ruin the case. A properly turned case neck should have most of the cutting action visible only on the high side. It is not necessary to turn the entire circumference of the case; this could result in a case neck that is too thin to properly grip a bullet.

Case Forming

Many cartridge cases share similar dimensions. Because of this, a case of one caliber can be used to form a case of another caliber.

Handloaders normally reform cases for three reasons. First, they wish to reload a cartridge for which factory cases are either hard to find or discontinued. As an example, there are a number of Mauser rifles in circulation chambered for the 7.65mm Argentine Mauser cartridge but only one make of imported brass is available in this country. The Argentine case has the same head and body diameter as a 30-06 but is shorter. The larger '06 case can be reformed to make excellent 7.65 Mauser cases with a minimum of extra equipment.

The second reason is that the handloader owns a rifle chambered for a "wildcat" cartridge. A wildcat is a custom cartridge derived from an existing factory case. Many popular commercial cartridges we shoot today started life as wildcats. Notable examples are the 257 Roberts, the 25-06, the 35 Whelen and the 22-250 Remington. All these enjoyed considerable success in custom rifles before the major gun and ammunition makers produced the commercial versions. Because all wildcats are based on an existing case, the wildcat cases are produced by reforming.

RCBS Special Order dies are available from the 14 Flea to the 600 Nitro Express

Another reason for reforming is that the handloader has a supply of one cartridge case but needs cases for another. One gentleman was given several thousand 300 Winchester Magnum cases but really needed 270 Weatherby cases. With the help of a set of RCBS case forming dies, he reformed some of the 300 Winchester cases to get a lifetime supply of 270 Weatherby brass.

Reforming operations are similar to case sizing in most respects. For a simple conversion, it is often possible to use standard sizing dies. The 257 Roberts case can be formed from 7mm Mauser brass by running the Mauser cases into a properly adjusted 257 Roberts sizer die. Because the cases are nearly identical except for neck diameter, no other forming is necessary except checking case length and, if necessary, trimming.

Other case conversions are more complex. If the new case is significantly shorter than the parent case, metal in the newly formed neck will be too thick and neck reaming dies are required. When the neck diameter or case length needs to be changed significantly, it is often necessary to perform the conversion in steps. Often, an existing sizer die for another cartridge can be used as an intermediate step. For example, in forming the 6.5-06 wildcat from 30-06 cases, a 280 Remington full length sizing die can be used to provide an intermediate step between the parent case and the wildcat.

Many conversions require an operation known as *fire-forming* which uses the pressure of firing to contour the case to the dimensions of the rifle's chamber. In some wildcats, referred to as "Improved" cartridges, the only difference between the wildcat and the parent cartridge is the body taper and the shoulder angle. For these, the new case is often made by simply firing a standard case in the custom rifle. In more complex conversions, fire-forming is usually the last step.

RCBS produces case-forming die sets for most standard and wildcat cartridges. They are designed to provide the proper step-forming procedure to produce accurate cases with minimum loss during forming. Each set includes complete instructions for the specific conversion. Information on RCBS case forming sets can be obtained by calling or writing the Special Order Department at RCBS.

Easier Neck Expansion for Bottleneck Cartridges

When set up in the normal manner, a sizer die performs neck expansion just before the case exits the die body since the expander ball is near the mouth of the die. Because you encounter the normal resistance of the ball at a point in the press stroke where leverage is relatively low, there is a noticeable hesitation when the case neck meets the expander.

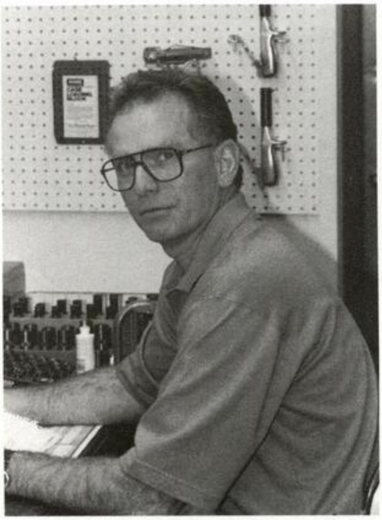
This hesitation can be nearly eliminated if you are sizing cases that have already been deprimed in a separate operation (for example, if you deprime cases prior to cleaning). If this is the case, loosen the lock nut that holds the expander rod in the guide bushing. Unscrew the expander rod until the top of the expander ball is roughly even with the shoulder section of the die. Make sure that the ball is not in the neck of the die or the cases will not be expanded. Tighten the lock nut and continue with sizing.

With the expander ball in this higher position, the case neck passes over the ball during the portion of the press stroke when leverage is fairly high. You will hardly feel the expander pass through the neck.

Remember that this technique works only with bottleneck cases that have already been deprimed. If you plan to deprime as you size, leave the expander in its normal position. This technique is not necessary if you are using RCBS Competition dies. The expander ball is already at a high position even when the sizer die is set to deprime.

Chamber Casting

Although most sporting rifles are built to very consistent tolerances, it is sometimes useful to know the exact chamber and throat dimensions of your rifle. More often than not, the most useful information gained is the throat dimensions. Although chamber dimensions are relatively uniform in production rifles, throats can vary a lot. The amount of free-bore and the throat diameter are the two most useful dimensions to know. Free-bore is the length of the unrifled section of the throat before the rifling starts. If your rifle has a long free-bore, you will probably achieve the best



Charlie Gaustad, RCBS Warranty Tech.

accuracy with longer seating lengths, assuming the magazine will accommodate the longer cartridge. The diameter of the throat should be less than 0.002 inch over bullet diameter for best accuracy.

A good chamber cast gives you a "snapshot" of the throat. This part of the barrel is the most stressed in shooting. A rifle with a badly worn throat will usually shoot poorly even though the rest of the barrel looks good.

A chamber cast is made by plugging the bore about an inch ahead of the chamber with a cotton patch and pouring a low melting point metal such as Cerrosafe® into the chamber. Cerrosafe is available from gunsmith supply catalogs. Follow the instructions supplied with the casting material to obtain the most accurate measurement.

Measuring Bore Diameter

It's often helpful to know the exact diameter of your barrel, especially when different bullet diameters are offered by various manufacturers. Simply measuring just inside the muzzle with an inside caliper seldom gives an accurate reading. The most common method is called "slugging" the bore and is used with barrels having an even number of grooves.

To slug the bore, clean the barrel thoroughly and apply a very thin coat of light machine oil. Select a soft lead slug such as a buckshot pellet or a soft cast bullet that is just large enough that it cannot be pushed into the bore by hand. Place the lead slug on the muzzle and drive it flush with a soft-faced mallet. Then use a short section of hardwood dowel (which measures just under bore diameter) to drive the bullet in a few inches. This step will usually cause a ring of excess lead to be cut off. This is normal and indicates a proper fit. Remove the dowel and continue driving the slug with a longer dowel until the slug falls from the chamber. The slug will be engraved by the rifling and can be measured with calipers or a micrometer. Be sure to measure the slug at several places and use the maximum dimension as the bore diameter. Never attempt to use a jacketed bullet as the slug. It will be nearly impossible to drive through the bore and could become stuck.

Some barrels have an odd number of grooves. Accurate measurement of these is difficult without special gauging equipment.

Determining Twist Rate

In this manual, you will see reference to the rate of rifling twist. All rifled barrels have a certain rate at which the lands and grooves of the barrel will rotate the bullet. Twist rates for our commercial test rifles are listed in the data section of this book. However, you can measure the twist of your rifle using simple tools.

You will need the following items:

- *a metal cleaning rod appropriate for your rifle's bore.*
- *jag tip and patches of the correct size*
- *a long straight-edge, such as a yardstick*
- *a dark-colored, fine-point felt-tip marker*

Lay the cleaning rod on the bench and, using the straight edge, draw a long line with the marker the full length of the rod parallel to its axis. Place the jag and patch on the rod and start the rod into the barrel from the muzzle. If the patch fits properly, the rod should rotate smoothly. Stop the rod so that the line you drew is facing up. Make a cross mark on the rod with the marker even with the muzzle. Now push the rod slowly through the bore making sure it is rotating. When the long line returns to the same position (facing up), make another cross mark even with the muzzle. Remove the rod and measure the distance between the two cross marks. This is the barrel's rate of twist.

CHAPTER 9

AUTOMATING THE LOADING PROCESS

[Progressive Reloading Equipment]

The 1980's saw a tremendous growth in new shooting activities. Among these were several pistol sports such as IPSC, NRA Action, bowling pin and steel plate speed shooting. The common denominator for all of these events is that the participants burn up a *lot* of ammunition. It is not unheard of for the top shooters in these competitions to shoot 30,000 to 50,000 rounds a year or more!

These competitive shooters and others who shoot large quantities of ammunition often find the single-stage reloading press inadequate for their ammo needs. These shooters fire a lot of ammunition and cannot spend a great deal of time loading. This demand has sparked a tremendous growth in the development of faster ways to reload ammunition.

Progressive reloading presses perform all of the steps described in the operation of a single stage press; however, the steps are performed on several different cases at the same time. This is accomplished by providing multiple die stations and a carrier or shellplate which holds several cases at once. A typical progressive press will resize and deprime one case, expand the case neck (straight wall cases) and seat a new primer in another, charge yet another case with powder, and seat the bullet in still another.

These operations are normally performed simultaneously with one stroke of the press handle. This saves time by having the tool do several steps instead of one for each hand motion. Some tools are more automated than others. For example, one tool may advance the cartridges to the next station automatically while others require the operator to manually rotate the shell carrier.

Progressive reloading tools date back to the 1930's and earlier. The most popular and durable of the early tools was built by Star Machine Works. It is a five-station, manually-indexed machine of very robust design and construction. Star tools hold their value well, but their availability has always been limited .

"Don't become a "speed addict" just because you are loading with progressive equipment."

The Star machine is suitable only for handgun cartridges because it doesn't have sufficient length of stroke for most rifle cartridges. It represents one of the two distinct designs in progressive presses with its rotary shellplate. Most current progressive loaders for the consumer market are also the rotary type. RCBS, Dillon, Hornady and other modern presses fall into this category. Other progressive tools employ a straight-line path for the cases, while accomplishing the same operations. The most common straight-line machines are the various models of the C-H Autochamp™ and the RCBS Green Machine™.

Progressive reloaders were relatively expensive in the past. In 1977, the Star listed for $850 and the C-H and RCBS Green Machine were around $500. A Colt Government Model pistol would sell for only $300, so the tools were decidedly not for everyone. Other tools made for commercial reloaders were even more expensive.

Today, however, there are many tools on the market at prices affordable to most shooters. In addition, many of today's progressive presses can load rifle cartridges as well as handgun. Their designs range from three to eight stations. Selecting a tool becomes a choice of features the shooter needs or can afford.

RCBS offers two progressive presses, the AmmoMaster™ Auto and the Auto 4x4™. In addition, the Piggyback™ II conversion unit allows progressive loading on Rock Chucker™ and Reloader Special™-3 and -5 single-stage presses. The AmmoMaster and Piggyback are five-station presses, while the Auto 4x4 has four stations. When comparing the number of stations, remember that the powder measure must occupy one die station.

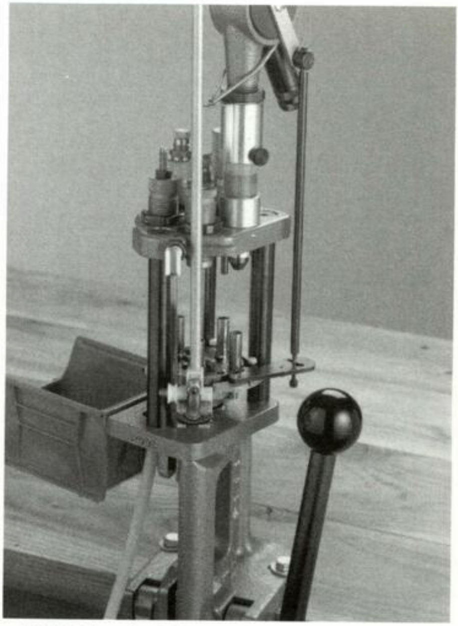
Like the Star machine, the five-station RCBS presses operate on several cases at once. Unlike the Star, the AmmoMaster Auto will work with rifle cartridges up to and including the big 416 Remington Magnum. Cartridges up to 30-06 length can be loaded on the Auto 4x4 press.

Because of significant differences among the various makes of progressive presses, we will not attempt to give a complete review of their operation. For details about the safe operation of your progressive reloader, consult the instruction manual furnished with it. If it is not available, contact the equipment manufacturer for a copy.

The Pros and Cons

Progressive reloading tools, like other mechanical devices, have their strong points and weak points; rest assured that the pros outweigh the cons.

On the plus side, the most obvious benefit is *capacity*—the amount of finished ammunition which can be assembled in a specific period of time. Most progressive reloaders will produce between 200 and 400 rounds per hour at a safe, steady pace. Such a pace minimizes the chance for error and will produce reliable and accurate ammunition. Trying to increase the rate of production may result in unsafe loading practices and the quality of the finished product will usually suffer.



RCBS Piggyback II

Don't become a "speed addict" just because you are loading with progressive equipment. Load at a comfortable pace; you will still be ahead compared to single-stage loading. Powder hoppers and primer tubes run low eventually. Stopping to fill them will reduce the hourly output, but this is a necessary part of progressive loading.

Operating the equipment so that a finished cartridge is produced every ten or fifteen seconds allows the operator the time to handle the components and verify that the equipment is cycling in a safe and satisfactory manner. The equipment should always be operated smoothly. Never use a "jerking" motion when loading. This can cause irregular powder charges or tipped primers. Cases which are snapped from one station to the next can lose part of their powder charge. Also, operating the tool too fast may cause you not to notice resistance to normal operation. Poor ammunition or damage to the equipment may result.

With care, ammunition loaded on a progressive tool will be every bit as accurate as ammo loaded on single-stage equipment. Because quite a bit of hardware is attached to the powder measure, progressive presses often damp out slight variations in operator technique, resulting in very uniform charge weights with many propellants.

The only real drawback to a properly operated progressive loader is that you have less chance to perform in-process inspections. A high primer won't be found until the cartridge is fully loaded and you often won't be able to inspect every case for a powder charge before seating bullets. However, with reasonable loading techniques (and a couple of RCBS accessories), these problems can be minimized or avoided.

High primers are commonly caused by a build-up of residue in the primer pocket after several firings. One way to avoid this problem is to periodically decap the cases in a universal decapping die (available from RCBS) and scrape out the residue before putting the cases back through the progressive press. This is also a good time to clean and inspect the cases.

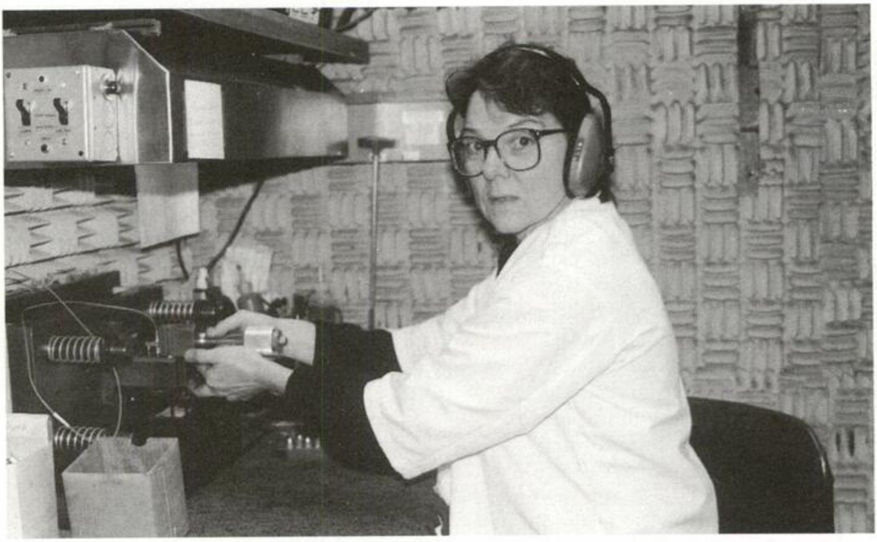
The best insurance against a missing or light powder charge is by using one of these unique RCBS products—the Powder Checker™ or the Lock Out Die™. The Powder Checker is a visual powder level indicator which is installed in the die station just past the powder measure. As the press ram reaches the top of its stroke, a glance at the Checker will indicate if the charge is over, under or missing. The Powder Checker works with any type of metallic cartridge.

The Lock Out die performs a similar function but is designed for straight-wall pistol cases. When a charge that is too heavy, too light or missing is detected, the Lock Out die halts the ram travel abruptly. The operator is instantly aware that a problem exists even if he is not paying attention. Both of these safety devices are best suited to five-station presses.

As you routinely decap on the progressive press, a build-up of primer debris can accumulate under the shellplate. Regular cleaning will prevent this from causing mechanical problems. Use a brush or compressed air to clean under the plate every time you change plates. Also clean under the primer shuttle if your press has one. If you don't change the shellplate very often, remove it every 1000 rounds and clean anyway. Clean up any spilled propellant immediately.

Sizing Dies in Progressive Loaders

For progressive reloading of pistol cartridges, a carbide sizer die is



Linda Bauer, CCI/Speer Centerfire QA Technician, function P and V testing.

almost mandatory to eliminate the need to lube cases. In addition to greatly speeding up the process, you will avoid handling greasy cases with the same hand that handles bullets. Getting case lube on bullets can, at best, cause irregular bullet pulls and, at worst, contaminate the powder and cause a misfire.

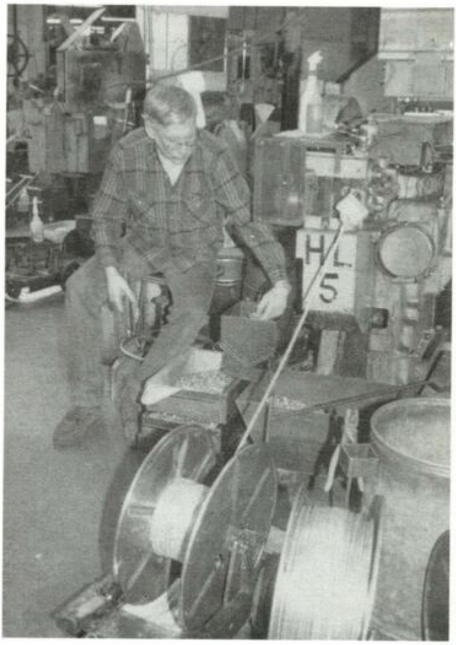
Few hobbyists own carbide dies for bottleneck rifle cartridges, so the best way to avoid the problems of excessive lubricant is to use the RCBS Lube Die. The Lube Die has a reservoir for liquid case lube which is automatically metered onto a felt ring at the mouth of the die. The die, installed in station one, also deprimes the case. The case sizing die is installed in station two with the decapping pin removed. The Lube Die is available in four sizes to handle most popular bottleneck rifle cartridges.

Powder Choice

Because progressive presses move the cartridge case from station to station, some vibration is bound to occur. Cases filled to the top with propellant can shake out part of the powder before the bullet is seated. Selecting a powder and charge weight which keeps the powder level well below the case mouth will minimize spilling propellant as the shellplate rotates.

A number of loads in this manual and others call for compressed powder charges. Most progressive loaders can handle a little compression without a problem, but we recommend that heavily compressed loads be avoided when using rotary progressive loaders. Because the case is not directly over the centerline of the ram during seating, slight flexing of the shellplate carrier may lead to inconsistent bullet seating depths when heavily compressed charges are used. It's usually best to assemble such loads on single-stage equipment.

When loading large-capacity rifle cases, be sure to pause a second or two with the ram at the top of its stroke. This insures that the propellant charge will have time to pass through the powder measure and into the case. Operating the press too fast will produce ammo with light charges or cause propellant spills.



Dale Taylor, CCI/Speer Machine Operator, monitors lead core header.

Safety with the Progressives

Although each press manufacturer's design and operation varies, there are several universal safety guidelines:

- Read and understand all written instructions furnished with the equipment. Progressive presses are quite complex compared to single-stage equipment. If you don't understand something, call the equipment manufacturer for help. Most have a toll-free number for technical assistance. Use it!

- Always wear eye protection when reloading, regardless of the type of equipment being used.

- Avoid anything which may distract your attention when loading. Progressive presses have many operations happening at once and require your full attention.

- Develop the habit of routinely checking all parts and connections for tightness, alignment and fit. Keep the press clean and lubricate it only according to the manufacturer's recommendations. Excessive lubrication can cause problems if allowed to build up.
- Never attempt to modify built-in safety features of any reloading tool.
- Never attempt to increase the capacity of primer feeders and powder hoppers beyond their original design, unless the modification is authorized by the tool manufacturer.
- Make certain that replacement primer tubes are the correct ones for the make and model of your tool. The wrong tube can lead to big problems, including primer detonation.
- Don't rush! Operate the press with a smooth, even stroke of the handle and try to maintain a steady pace of one finished round every ten or fifteen seconds. Never attempt to load so fast that you cannot keep an eye on all equipment functions.
- If you get tired, take a break. Operator fatigue can lead to major problems.
- When operating the press for the first time, use a slow, deliberate pace to get the feel of the equipment. Knowing what feels "normal" makes it easier to detect malfunctions that may happen later.
- Never use excessive force. If you feel something out of the ordinary, STOP LOADING IMMEDIATELY, and do not resume operation until the cause is found and corrected.
- Develop a routine for picking up cases and bullets, and coordinate these actions with the stroke of the press handle.
- Case preparation is still important when loading on progressive equipment. Check cases for defects, mixed calibers, and proper length before loading.

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Observe these guidelines and you and your progressive reloader will soon be producing an impressive amount of quality ammunition in complete safety.

• • • • • • • • • • • • • • • • •

Ron Smith, RCBS R & D Technician, bagged this massive Nelson Bighorn Sheep in the Mesquite Mountains of California. It scored a 168 in B & C. (25-06 caliber, 100 gr. boat tail)

WHEN ALL ELSE FAILS: TROUBLESHOOTING TECHNIQUES

As with anything we do, we all hope that reloading goes smoothly. However, sometimes things happen which aren't according to plan. This section is included to help you diagnose and fix problems which may occur during the loading process or at the range.

SIZING PROBLEMS

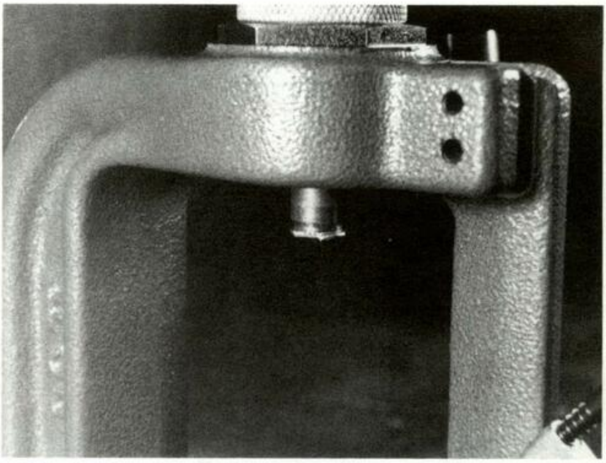
Stuck Cases

By far the most common sizing problem is sticking a case in the sizer die. When you lower the ram, the shell holder pulls the rim off the case and you're out of business. There is usually only one cause for this problem—little or no lube on the case. Frictional forces during sizing are very high and, without adequate lubrication, the case will seize in the die.

Removing a stuck case from the die takes care and some special equipment to avoid permanent damage to the die. The stuck case itself seldom harms the die; it is improper removal which causes the damage. RCBS makes two tools to handle this problem: the Stuck Case Remover and the Stuck Case Remover 2 Kit. The former is used with standard dies and the latter is used with dies having a removable guide bushing or elevated expander balls like RCBS Competition dies. Both units are designed to gently ease a case from the die. The case is lost but not your precision die. If you do not have one of these tools, you can send an RCBS die to their customer service department for free case removal.

To avoid this problem make sure the case has enough lube. When using a new die for the first time, remove the shipping preservatives from the die. For bottleneck cartridges, push any material from the vent hole in the side of the die with a paper clip. Flush the die with an aerosol solvent such as Outers Crud Cutter™.

The first case sized in a new die may require more lube than subsequent cases. After the first few cases are sized, less lubricant can be used. If you feel a case hesitate as it enters or exits the die, make sure the lube pad has enough lubricant before sizing another case.



Trouble! A case has struck in the sizer die.

A die which has been damaged by sizing too many gritty cases will become rough enough to increase resizing forces. Stop using the die until it can be repaired or replaced. To avoid this problem in the future, make sure that cases are clean before sizing.

Dents in the Case Shoulder

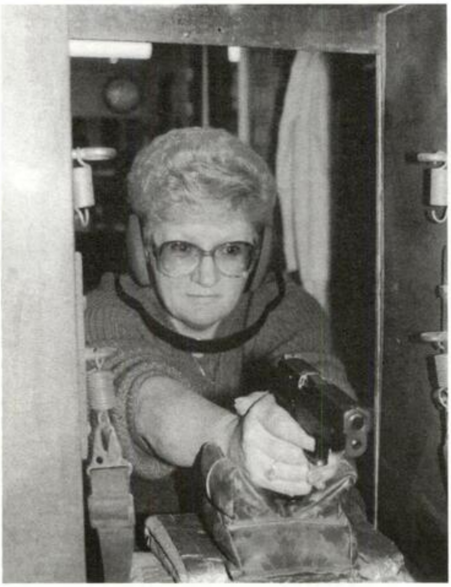
On the other hand, you can have too much of a good thing. Although lubrication is necessary, excessive lube can collect in the shoulder area of the die. When a case is sized, the trapped lubricant creates hydraulic dents in the shoulder. The vent hole normally allows lubricant to escape; however, if force is applied rapidly, excess lube may not vent fast enough to prevent dents. If you find hydraulic dents, first check to see that the vent hole is clear and clean it if needed. Excess lube on the pad can be removed with a clean shop rag. Remember that only the case body needs lubrication, not the shoulder and neck.

A dented case may fire normally without failing, but may be weakened. Rather than take the chance of a case failure, you should discard the case.

Difficult Sizing

If you notice that you need to exert more force than usual when sizing (even though the case is properly lubed and the die is clean), here are a few thing to check:

- Make sure that you have the correct die installed.
- See if the case is the correct one. A 358 Winchester case is similar in appearance to the 35 Remington but is larger in diameter.
- See if the case was excessively bulged from previous firings. Some surplus military cases that have been fired in machine guns will have more bulge than cases fired in a sporting rifle.
- Check the case for major dents or a heavy coating of corrosion or debris.


Dorothy Shaul, CCI/Speer Centerfire QA Tech.

Special Sizing Dies for Semi-Automatic Rifles

Difficult chambering or extraction can occur in some makes of semiautomatic rifles and can usually be corrected with RCBS Small Base sizing dies. These dies reduce the case diameter slightly more than a standard sizer die. The resulting case is usually closer to original factory base dimensions.

Chambering and extraction problems can also be evidence of a dirty chamber. Keep the chamber clean and dry. You may find that some propellants leave less residue than others. Trying different propellants may point the way to one which leaves your rifle cleaner.

Headspace Problems— Bottleneck Cases

Remember that the headspace for a bottleneck cartridge is controlled by the position of the shoulder. If the case shoulder is pushed back too far during sizing, excessive headspace will result and cause poor accuracy or misfires. In the worst case, a case rupture might occur, which can ruin the rifle and injure the shooter.

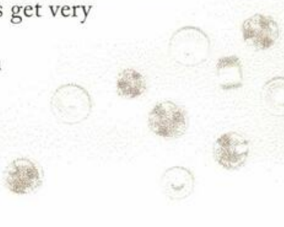
Shoulder position can be accurately measured to ±.001" with the RCBS Precision Mic™. See Chapter 8 for more information on this tool. Other firms offer cartridge gauges which indicate a "go" or "no-go" condition. Due to the quality of current reloading dies, over-sizing is rare. However, three factors can cause this to occur:

- The sizer die or shellholder has been modified by removing metal from the top of the shellholder or the bottom of the die body. Either alteration puts the shoulder of the die too close to the shellholder resulting in cases which create excess headspace. NEVER attempt to modify a sizer die or shellholder.
- The sizer die and shellholder are different makes. Most manufacturers of dies and shellholders use the same reference dimensions, but an occasional mismatch can occur. Usually it is small and does not create a safety hazard. Avoid homemade shellholders entirely; you have no guarantee that they are dimensionally correct.
- A rifle has an overly "long" chamber. Even though the dies are properly adjusted, the case will fireform to a longer base-to-shoulder length. Normal sizing pushes the stretched shoulder back each time, reducing accuracy potential and case life. The Precision Mic will tell you if your rifle has this condition. Once you know the amount the shoulder moved during firing, you can adjust your sizer die so that the shoulder is moved back only about .002" and the cases are now custom-fitted to your rifle. However, they may not function in another rifle with a tighter chamber.

The problem of over-sizing is more prevalent with belted cases. Review the section on sizing bottleneck cases in Chapter 8.

NECK EXPANSION PROBLEMS

If neck expanding seems unusually difficult, remove the expander assembly and inspect the expander ball. Expanders get very dirty. Grit that accumulates on top of the ball increases the force needed to start the expander ball into the case neck. Check to see if the rod is bent. Normally, expander balls will process tens of thousands of cartridges without showing wear; however, if quite a few really dirty cases have been processed, the working surfaces of the ball could become scratched. If so, polish the ball lightly or replace it.



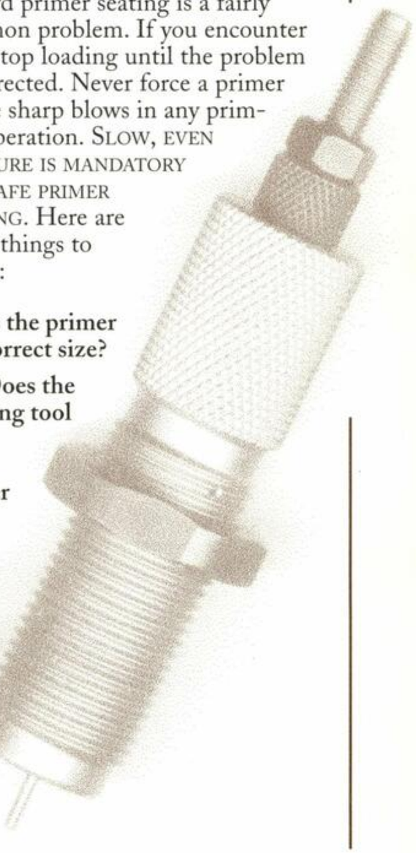
Fired cases have a dark powder residue on the interior. If this coating is unusually heavy, it can cause hard neck expansion even with a properly adjusted and maintained expander. Case necks should be brushed thoroughly with an RCBS case neck brush. If lubrication is desired, *lightly* roll the brush across your case lube pad before brushing. Remember—too much lube will contaminate powder.

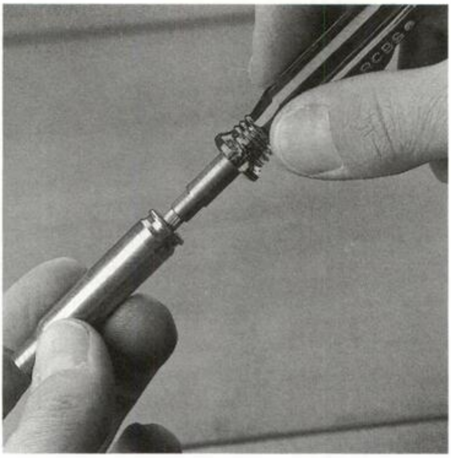
PRIMING DIFFICULTIES

Hard Seating

Hard primer seating is a fairly common problem. If you encounter this, stop loading until the problem is corrected. Never force a primer or use sharp blows in any priming operation. SLOW, EVEN PRESSURE IS MANDATORY FOR SAFE PRIMER SEATING. Here are some things to check:

- **Is the primer the correct size?**
- **Does the priming tool have the proper**





Use of RCBS Primer Pocket Brush.

primer punch installed?

- **Is the primer punch bent?**
- **On swing-arm primer punches (like in the RCBS Rock Chucker), is the arm free to move fully into position?** A build-up of primer residue can prevent the arm from centering under the case. The effect is similar to that of a bent punch—the primer cannot start into the case straight. Clean excess residue from the press regularly.
- **Is the primer pocket clean and undamaged?**
- **Does the case have a crimped pocket?** Completely remove any crimp with an RCBS Primer Pocket Swager before loading any more cases of that lot.
- **The shape of primer pockets can vary from brand to brand**—even within one brand. If the radius between the sidewall and the bottom of the pocket is too large, it will stop the primer cup prematurely causing a high primer. Tools are available to remove the excess material from the pocket and greatly improve seating.

Primer Feeding in Progressive Reloading Equipment

Progressive reloading presses handle primers through automated feeding devices. Most malfunctions with these priming systems can be traced to dirt and residue in the mechanism.

Progressive equipment must be cleaned regularly to insure safe and smooth operation. Remove the shellplate in rotary-type loaders and clean under it. Keep the primer shuttle and the surrounding area clean.

Check primer feed tubes for residue and straightness. REPLACE ANY BENT TUBES; NEVER ATTEMPT TO REPAIR THEM.

If you suspect that the priming mechanism is improperly adjusted, review your instruction manual to learn the procedure for proper adjustment. If in doubt, contact the equipment manufacturer.

POWDER CHARGING

This critical area of reloading is, fortunately, one where few problems occur. However, there are two problems which might be encountered.

Missing Powder Charge

A missing powder charge will cause a misfire. It is also possible for a primer alone to drive the bullet out of the case and stick it in the bore— a dangerous condition if another cartridge is fired! Hopefully, any questionable cartridges will be caught in the shop instead of at the range.

If you suspect that you have failed to charge a case after you have seated the bullet, a simple test will help you find out. Place a primed, uncharged case (same brand) and a bullet of the same weight you loaded in the scale pan and record the weight. Then weigh the suspect cartridge. If the weight of the suspect cartridge is within a few grains of the weight of the bullet and primed case alone, then the charge is missing.

Missing powder charges can be eliminated by proper charging practices and inspection. Review Chapters 7 and 13 for the recommended procedures.

Progressive loading equipment offers fewer opportunities for inspection than single-stage equipment. Review Chapter 9 for more information on these tools.

Variable Powder Charges

A charge variation of a few tenths of a grain in a large rifle case will have little or no effect on performance. However, variations of several grains will cause problems. Accuracy can suffer and charges falling on the high side may cause excessive pressures. These large variations are usually caused by improper powder measure techniques.

Be certain that you operate the handle in a consistent manner. When throwing large charges of rifle powder, allow enough time for the entire charge to flow through the measure. Check the powder measure routinely to see that all lock screws and fittings are tight.

If you are not using a powder measure and get large variations in hand-weighed charges, make certain that your scale is clean and sitting on a level surface. If you move the scale to another location in the shop, rezero it before weighing powder again. Check the scale with a calibrated weight check set available from RCBS and other manufacturers. Is the scale being affected by drafts? An inexpensive deflector placed over an air vent or around the scale will eliminate the problem. Mechanical scales must be located at least three feet from fluorescent light fixtures to avoid interference from electromagnetic fields.

BULLET SEATING PROBLEMS

Hard Bullet Seating

Hard bullet seating can ruin cases for further reloading. Here's a check list:

- **Are you using the proper diameter bullet?** A 7mm bullet is .007" larger than a 270 Winchester bullet and would cause not only hard seating but dangerous pressures if the cartridge were chambered and fired.

- **Has the case neck been properly sized and expanded?** If you failed to adjust the expander ball properly, the bullet can collapse the case. The expander rod in some makes of dies can loosen and slide up and the case neck is not expanded at all.

- **On straight-wall cases, is there enough flare on the case?** Variable flare is often due to non-uniform case lengths.

- **If loading new cases, have you chamfered the inside of the case mouth?** Chamfer after you have made sure the case mouth is round; otherwise, you will have an uneven chamfer.

Bullets Fall into the Case

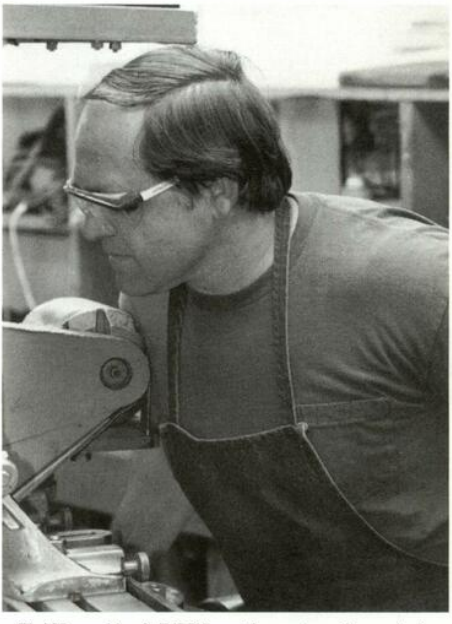
This is an easy problem to spot and fix. Check the following items:

- **Are you using a bullet of the correct diameter?**

- **Did you fail to properly size the case?**

Lead Bullets that Seat Deeper as Loading Progresses

This is caused by bullet lubricant building up on the seater plug and



Ted Youngblood, RCBS employee operating grinder.

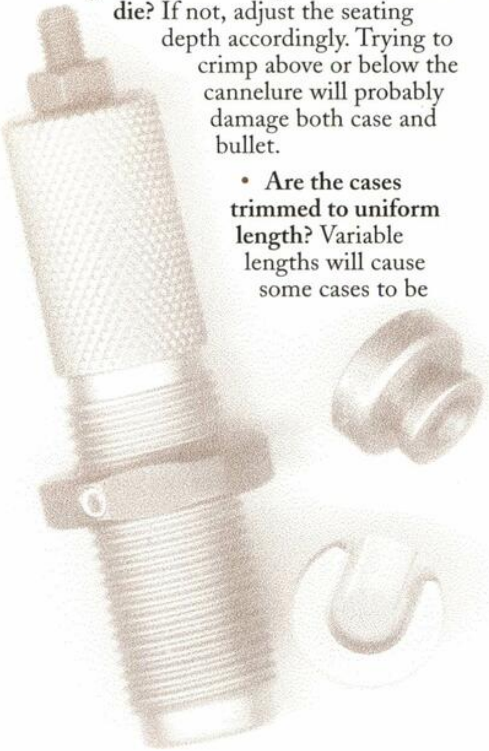
the crimp shoulder. The build-up increases gradually as seating progresses, pushing each bullet slightly deeper into the case until the seating depth is excessive. In some cartridges this can cause excessive pressure. Remove the seater die, disassemble and clean thoroughly. A *very light* coat of oil or release compound will slow future build-up. Remember, though, that too much oil is worse than none at all!

CRIMPING PROBLEMS

Remember that you should not attempt to roll-crimp jacketed bullets which do not have a crimping groove. Doing so will only damage the bullet and degrade accuracy.

If you have trouble crimping bullets which have a crimping groove, look for the following:

- **Is the proper die installed in the press?**
- **Is the seater plug adjusted so that the bullet stops with its crimp groove at the crimp shoulder in the die?** If not, adjust the seating depth accordingly. Trying to crimp above or below the cannelure will probably damage both case and bullet.
- **Are the cases trimmed to uniform length?** Variable lengths will cause some cases to be crimped too much and others to very little. If cases are trimmed too short, you may not be able to crimp them at all.
- **Are you collapsing the case mouths or shoulders during crimping?** If so, you are applying too much crimp. Adjust the die to apply less crimp. When crimping bullets in cases with thin mouths (32-20, 44-40, 375 H&H, 416 Remington, etc.) you may find that seating and crimping separately will minimize this.



"ERASERS" FOR RELOADERS

If you discover that you have made a mistake, you will need to take the defective cartridge apart to salvage the components. Just as pencils have erasers to correct mistakes, the reloader has access to a couple of different ways to "erase" his errors. Bullet pullers do the job, and come in both collet and inertial types.

Collet Bullet Pullers

Collet-type bullet pullers, available from RCBS and other manufacturers, mount in the die station of a single stage press. The puller unit usually consists of three parts: a body, a threaded screw with a handle attached and the collet. Collets are caliber-specific—you will need a collet for each diameter bullet you need to pull. A 30 caliber collet will work with most standard .308" diameter rifle bullets.

The puller body is screwed into the die station and the collet attached to the handle assembly. Insert the cartridge into the proper shell holder and raise the ram so that the bullet (but NOT the case mouth) fully enters the collet. Turn the puller handle clockwise until the bullet is firmly gripped. Give the press handle a sharp upward blow to lower the ram and extract the bullet. Turning the handle counterclockwise releases the pulled bullet from the collet.

The pulled bullet will likely have shallow marks from the collet jaws. Most bullets' performance will not be affected by these marks and can be reused. However, thin-jacketed varmint bullets may be crushed in the process and should be discarded.

A less elegant, homemade variation of the collet bullet puller requires only a pair of locking pliers. Remove the dies from the press and place the cartridge in the shell-holder. Raise the ram so that the bullet protrudes above the top of the press. Grasp the bullet with the pliers and lock the jaws. Jerk the handle up so that the ram moves sharply down to extract the bullet. It will not be salvageable because of deep plier marks and continued use of this technique can damage the press. This method is best reserved as an emergency measure only.

RCBS Inertia Bullet Puller

Inertial Bullet Pullers

The collet-type puller cannot be used to pull soft lead bullets or wadcutter pistol bullets and can damage thin-jacketed varmint bullets. Some jacketed handgun bullets may have too much taper to allow the collet to grip them securely. In these situations an inertial puller is the answer.

Inertial pullers look like hollow hammers. The cartridge is placed in a chuck assembly which tightens to grip the rim or extraction cannelure with the cartridge inside the puller body. The assembled unit is struck against a hard surface. The puller and the cartridge case stop, but the inertia of the bullet causes it to continue out of the case.

Bullets removed with the inertial puller are seldom damaged unless excess force is used. The bullet and powder charge are caught in the puller body for easy reclaiming.

Do not try to pull the bullet with one hard blow. Several light blows will pull the bullet safely and effectively. Heavy blows can break the puller or deform the bullet and may present a safety hazard.

Here are some safety precautions to follow when using an inertial puller, regardless of make:

- **NEVER** attempt to pull the bullet from any rimfire case.
- **NEVER** use an inertial puller to pull bullets from cartridges with high primers. Under certain conditions, the primer can snap hard against the bottom of the pocket and ignite. Use a collet-type puller if possible.
- **NEVER** attempt to disassemble any cartridge whose projectile type cannot be positively identified. Accidents have occurred when someone attempted to pull an explosive military projectile.
- **ALWAYS** use short, light blows instead of one heavy blow to remove the bullet.
- **ALWAYS** wear safety/shooting glasses when pulling bullets, just as in any other stage of reloading.

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Tech Tip: Some factory ammunition, particularly military ammo, has a mouth sealant which effectively glues the bullet in place. When disassembling ammunition that may have this seal, run the cartridge into a bullet seating die of the proper size and seat the bullet about .005" deeper. This normally breaks the seal and makes extraction much easier.

AT THE RANGE

Sometimes problems with reloaded ammunition do not show up until you get to the range. They may be functional problems but also could be accuracy problems.

Misfires

Misfires have been discussed in the section on components but this problem is common enough to warrant additional discussion. By far, the majority of misfire problems are due to a handloading error or a gun problem—not a primer defect. Here are ammunition-related items to check in case of a misfire:

- **Is the cartridge the correct one for the firearm?**
- **Is there propellant in the case?** Weighing the cartridge and comparing it to a primed case and loose bullet of the same type will usually tell you if the charge is missing.
- **Did you fail to remove the old primer from the case?**
- **Is the primer seated below flush?** Failure to do this is the most common cause of misfires in reloaded ammunition. The anvil legs must make firm contact with the bottom of the cup. CCI primers should be seated between .003" and .005" below flush for optimum sensitivity.

- **Has the primer or ammunition become contaminated with oil or water?**
- **In a bottleneck case, has the shoulder been pushed back too far?** This creates excessive headspace and the firing pin has to reach too far to make solid contact with the primer. Shoulder position can be checked with the RCBS Precision Mic.
- **In a straight-wall rimless case, is the case too short?** This has the same effect as moving the shoulder back too far in a bottleneck case. Measure the case length with calipers and check against the minimum case length in the reloading data.

Misfires can also be due to gun problems. Firearms-related items to check are:

- **Is the firing pin broken or damaged?** Check to see if a firing pin mark is on the primer.
- **Is the firing pin spring adequate?** Some after-market spring kits may not give the energy of the original spring. Original springs may be altered or weaken with age. See that the firing mechanism is properly assembled. Some revolvers have a screw which controls the position and tension of the mainspring. Make sure this screw is fully seated.
- **Is the firing mechanism coated with grease or dirt which can slow the firing pin fall?** This problem will most likely show up in cold weather. A spray degreaser like Outers Crud Cutter is useful for cleaning grease build-up.
- **Is there a build-up of powder residue or grease in the area of the chamber and breech face?** Residue here can cushion the firing pin blow, especially with rimmed cartridges. Careful, thorough cleaning will usually correct the problem.

- **In rifles and semi-auto pistols, is there excessive headspace? In revolvers, is there excessive front-to-rear play in the cylinder?** This condition, called endshake, is due to normal wear. Excessive headspace or endshake cause the cartridge to be positioned too far from the firing pin, weakening the blow. Consult a qualified gunsmith to determine if excessive headspace or endshake is present and have it corrected before further firing.

The Bolt is Hard to Open

With any ammunition, hard bolt lift is a signal of DANGER. The cartridge may have produced excessive pressure, causing the brass case to deform past its elastic limit and wedge in the chamber. When you get the action open, examine the case for signs of high pressure. Do not fire any more loads from that batch.

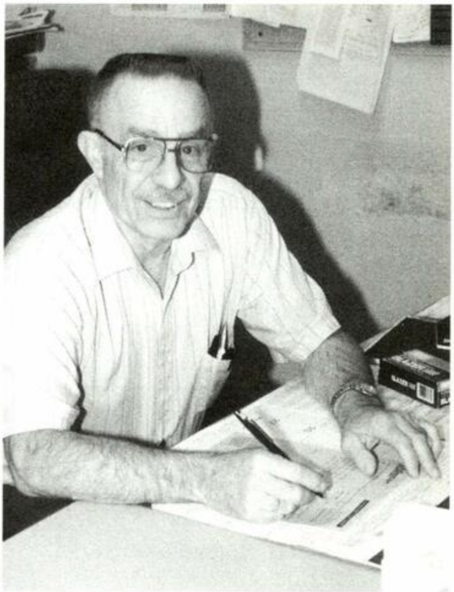
For safety's sake, always consider hard bolt opening to be a sign of excessive pressure. However, hard opening could also be due to a mechanical problem with the rifle, such as a rough or dirty chamber.

See if there is any grease or oil on the cartridge or in the chamber. Clean and dry the bore and chamber completely before each range trip. Cartridge cases are designed to grip the chamber walls at peak pressure and then release when the pressure drops. Oil in the chamber or on the cartridge will cause the case to slip in the chamber at peak pressure, increasing the stress on the bolt. This may cause hard opening at normal pressures. In addition, excessive lubricant in the firearm can attract and accumulate dirt.

Again, hard opening can be due to several factors, but your first reaction must be to think, "DANGER!" and cease firing until the cause is diagnosed and corrected.

Unusual Sounds and/or Recoil

Most firearms producing supersonic velocities (over about 1100 feet/sec) make a sharp crack when fired. You probably have a good idea of how your firearm sounds and feels when firing factory ammunition. A soft report and lack of recoil could indicate a squib load and the danger of a bullet being lodged in the barrel. Before firing any more ammunition, check for a bore obstruction.



Bob Evans, CCI/Speer Centerfire QA Supervisor.

If you hear a faint hissing sound following a shot, or hear a sound like the opening of a beverage can when you open the bolt, you almost certainly have a bullet stuck in the bore! The bullet has plugged the bore, and the residual gases are slowly escaping. Check the bore and clear any obstructions before shooting again.

Variable reports are a sign of inconsistent ignition (unless you know your velocities are near the speed of sound). These variations usually occur when using a hard-to-ignite propellant with a standard primer or when trying to develop reduced velocity loads in a large case. Either redevelop the load with a magnum primer or choose a different propellant.

Double sounds such as a "ker-whump" or a detectable delay between pulling the trigger and the cartridge firing are also signs of poor ignition. They are relatively common when working up reduced loads in large cases. Normally, switching to a quicker burning propellant will eliminate this problem.

Semi-Automatic Rifles

Even with small-base sizer dies, it is possible to have malfunctions in semi-auto rifles. For best performance in gas-operated semi-autos, use propellants having a medium burning rate. Slow-burning propellants may create too much gas for the gas system to handle, thus taxing the action. On the other hand, quick-burning powders may not generate enough gas to operate the action. Reloads should be kept close to factory velocity specifications for reliable functioning in these rifles.

Poor extraction can be caused by light loads or a dirty chamber. If you discover that fired cases are covered with tiny dents, powder residue has built up in the chamber. Clean the chamber with a chamber brush. Light loads can also cause poor extraction because they do not generate enough gas to fully cycle the action. Poor feeding can also result from light loads. The first round fired may have enough power to eject the fired case but not enough to move the bolt far enough to pick up the next cartridge in the magazine.

Some rifles function best with crimped bullets. Several Speer bullets feature cannelures so that secure crimping can be performed. If a reloader wants to shoot 150 grain bullets in a 30 caliber semi-auto, he can choose the 150 grain Mag-Tip which has a crimping cannelure. The crimp has two advantages in this class of rifle: it smooths the sharp edge at the case mouth and also prevents the bullet from being shoved into the case when it impacts the feed ramp.

Many semi-auto sporters have very light barrels. To effectively evaluate accuracy, allow sufficient time between shots for the barrel to cool. This recommendation also applies to any rifle with a slim barrel profile.

Poor Accuracy

There are many factors in shooting which can affect accuracy. We will assume you are shooting from a solid rest, and are using a firearm which has already demonstrated its ability to produce good groups. Before troubleshooting the ammo, it is a good idea to troubleshoot the gun as follows:

- **Do you have the proper ammunition?** Some cartridges will chamber and fire in firearms intended for a different cartridge. If you fired a 257 Roberts in a 7mm Mauser, the bullets would not properly contact the rifling and you would see “keyholes” in the target—if they even hit the target! Keyholes are elongated bullet holes caused by a tumbling bullet.

- **Are you positioning the firearm on the rest consistently?** Try to make each set-up as close as possible to previous ones.

- **Are the sights firmly attached to the firearm?** Screws can work loose from recoil, allowing the sights to move with each shot.

- **Are the screws holding the action in the stock secure?** A loose guard screw in a bolt-action rifle can open groups significantly.

- **Is the bore fouled with lead or jacket material?** This problem will usually show up later in the shooting session as more residue builds up in the bore.

- **Has a wood stock warped due to moisture absorption?** If your rifle and ammo shot well last season but refuse to perform now, a warped stock should be a prime suspect. If this happens, you should consult a gunsmith to have the situation corrected.

If these factors do not seem to be the problem, then review the things that can directly affect the ammunition:

- **Under-ignition—** This is usually caused by using a standard primer when a magnum primer is recommended. Large charges of slow-burning propellants need a strong flame to ensure full ignition. The shorter burning time of a standard primer may result in widely varying velocities. On the target, this usually takes the form of vertical dispersion (stringing) of the shots. This effect is more prevalent in cold weather.

- **Excessive headspace**— A bottleneck case with the shoulder pushed back too far or a rimless straight case trimmed too short can degrade accuracy.
- **Unnecessary crimp**— Have you attempted to crimp a rifle bullet which doesn't have a crimping cannelure? Tests by the Speer staff revealed that groups can open up 40 percent because this operation damages the jacket.
- **Mixed cartridge cases**— for accuracy testing, all cases in the test lot should be the same manufacture.
- **Excessive lubricant**— Have you removed all traces of lubricant from the cases? If not, cases will be inconsistent in the way they grip the chamber at peak pressure.
- **Wind conditions**— A strong, gusting crosswind will cause horizontal dispersion of the groups. Light, high-velocity bullets are more subject to wind conditions than heavier, slower bullets. There's not much you can do about this problem. You'll probably have to pack up and try again on a calmer day.

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Ammunition loaded with care and attention will give fine results on the range. Most problems arise from cutting corners and rushing the job. Reloading can be a pleasant hobby if you just relax and take the time to enjoy it.

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Hugh Dillard, Machine Shop Supervisor (l), and Lewis Nicholson, Machine Tool Operator (r), discuss the status of the current project.

CHAPTER 11

THE BULLET IN FLIGHT:

[An Introduction To Exterior Ballistics]

This chapter is a joint effort of CCI/Speer's Guy Neill, and Mike Gilbert and Kevin Schwinkendorf of ADC, Inc. ADC developed the Speer/ RCBS exterior ballistics computer program, PC Bullet™. *Our thanks to Mike and Kevin for their contributions.*

PC Bullet *can be ordered directly from RCBS by calling 800-533-5000.* PC Bullet *runs on IBM and IBM-compatible computers.*

After a bullet leaves the gun barrel, it is subject to the same physical laws as any falling object— gravity pulls it downward and air resistance slows it. Because the effects of gravity and air resistance are well known to scientists, the path of a particular bullet in flight can be accurately determined through *ballistics.*

Ballistics is the study of projectile motion. *Interior ballistics* studies velocity, time, temperature and pressure relationships from the moment the primer fires to the moment the bullet exits the gun barrel. The loading data in the Speer Reloading Manual are examples of interior ballistics.

Terminal ballistics studies bullet behavior from the moment the bullet enters its target until it stops. Bullet construction and velocity play important parts in terminal ballistics. For the hunter, this branch tells him which bullet will most effectively take the game animal he seeks.

Between interior and terminal ballistics we find *exterior ballistics.* This branch covers the bullet's flight from the gun muzzle to the target. Why does a shooter need to know the path of a bullet? This allows him to know where the bullet will strike at different ranges so he can sight in the firearm to best suit his shooting activity. Once the path is known, the shooter will know how much to adjust the point of aim at various distances. Thus you can see that learning about the bullet's flight is quite important to most shooting sports, and especially for hunting in open country where long shots are common.

In order to clearly understand ballistics, some terms must first be defined. The following list is not complete, but covers the important topics we will discuss.

- *Line of Sight*— the straight line of vision through the sighting device attached to the gun. Line of sight is the usual reference for trajectory.

- *Trajectory*— the actual bullet path through the air compared to the line of sight. While the line of sight is a straight line, the trajectory is a curved path. The sight settings determine the points where the line of sight and the trajectory cross. Figure One diagrams a trajectory. Trajectories may be determined from the Speer tables (in the reference section of this manual) or with Speer/RCBS *PC Bullet*™ computer software. Trajectory is controlled by the bullet shape, muzzle velocity and weather conditions.

- *Drop*— the distance the bullet falls below the centerline of the bore. Drop is usually calculated assuming that the axis of the bore is parallel to the ground.

- *Sectional Density (SD)*— a mathematical factor for any projectile defined as the weight of the bullet in pounds divided by the square of the diameter in inches:

$$\mathrm{SD} = \frac{\mathrm{weight}_{\mathrm{pounds}}}{\mathrm{diameter}^2_{\mathrm{inches}}}$$

- ***Ballistic Coefficient***— the sectional density divided by a form factor, *i*. The ballistic coefficient (BC) is a measure of the ability of the bullet to air resistance, or drag. A high BC value means the bullet will resist drag better.

- ***Ballistic Table***— a chart compiled to allow easy determination of a bullet's characteristics under varying velocities and ranges with respect to muzzle velocity and BC.

According to Lowry in *Exterior Ballistics of Small Arms Projectiles*, four things are needed to describe a trajectory. These are the muzzle velocity, the angle of the bore at the instant of firing, the atmospheric conditions and the physical characteristics of the bullet (ballistic coefficient). The ballistic tables in this manual assume standard atmospheric conditions and are shown for several zero ranges, which account for the bore angle. To use the tables, find the muzzle velocity appropriate for the ballistic coefficient and read the trajectory for the ranges listed.

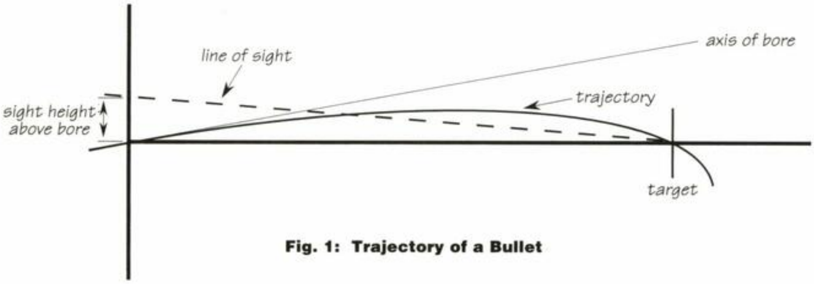


Fig. 1: Trajectory of a Bullet

History of External Ballistics

Exterior ballistics dates to that moment in history when some ancient gunner discovered that he had to change the angle of his cannon barrel to move the point of impact. Early theories of ballistics assumed the projectile traveled in a straight line for some distance and then dropped. Nothing was understood about drag caused by air— in fact, air itself was poorly understood back then. The straight line theory is easily disproved by simply throwing a rock. It actually arcs to its final resting place. This is the same motion a bullet goes through.

In the case of bullets, there are three distinct areas to the trajectory. The first is the distance immediately beyond the muzzle. Here, the bullet has not yet fully stabilized after the violent transition from the bore to free flight. Early researchers with their fondness for Latin termed this area the *motus violentus*. This zone can reach as far as 100 yards for some bullets.

The second area— the *motus mixtus*— is the portion of the bullet path where normal stability induced by the gun barrel is in effect. This zone represents the major portion of the bullet path.

The final area of the trajectory—the *motus naturalis* — is that portion where velocity has dropped so low that the bullet looses any artificial stability given it by the gun barrel. Natural flight is irregular, so the bullet tumbles and sheds velocity very rapidly.

The *British Textbook of Small Arms* (1929) lists similar areas of the trajectory, terming them, "short range, medium range and long range."

The actual arc of a bullet is not circular, but parabolic. This was first proved by Galileo in 1638, and was later refined to show that the path is a section of an ellipse, or oval. For our purposes, assuming the path follows a parabolic arc suits most applications. Classic theoretical projectile motion assumes that there is no drag from the air. In a place with no atmosphere— such as on some remote planet— a bullet would follow paths which can be calculated using fairly simple math.

Because we live and shoot on a planet with an atmosphere, there are further considerations. Everyone is already familiar with air resistance even if they cannot mathematically explain it. Dropping a sheet of metal and a piece of paper the same size results in the metal striking the floor first. Most of us know of the famous experiment that Galileo conducted showing the rate of fall is the same between heavy and light objects. So why doesn't the piece of paper hit the floor at the same time as the piece of metal? The reason is *air resistance* combined with *density*.

Air is made up of molecules of gases and, although quite thin, it resists any object moving through it. Density is the amount of mass an object has compared to its volume. While a piece paper and a metal sheet may be of the same size, they are quite different in density. The paper is light-weight but has little mass compared to the metal sheet. This low mass does not overcome the resistance caused by the air as well as the denser piece of metal. This is one reason that lead makes better bullets than a lighter material, such as aluminum, for most applications.

Perhaps an easier demonstration of this is to take two sheets of paper. Crumple one into a ball. Drop both and see which hits the floor first. The difference is the density. Crumpling one sheet packs its mass into a smaller volume and increases its density. Crumpling also reduces the surface area exposed to air resitance.

The resistance, or drag, produced by air was first described by Sir Isaac Newton in 1710. In his experiments, Newton showed that faster moving objects experience greater resistance from the air. The faster something tries to go, the more air tries to stop it.

It appears that the first application of air resistance to ballistics was by Bernoulli in 1718 after being challenged by another researcher, Keill. Bernoulli published his work in 1721.

A few years after Bernoulli published his work, Benjamin Robins, working with a ballistic pendulum, found that Newton's law of air resistance held until around 1100 to 1200 feet/sec. Through his experiments, Robins determined that when the speed of sound (approximately 1115 feet/sec) is exceeded, air resistance increases significantly.

Until the 1860's, all research had used round balls for the projectiles; however, elongated projectiles were becoming popular. Bashford, Professor of Applied Mathematics and Referee of the Ordnance Select Committee at the Royal Academy in England, began ballistic research with the new projectiles in 1864. To facilitate his research, he developed a new form of chronograph to measure velocities.

The Bashford chronograph gave surprisingly accurate results for its day and a series of firing tests began in 1865. For the English, Bashford's data were utilized until 1904 when new tests of modern artillery projectiles were undertaken. Ballistic research was also conducted in Russia, Germany and Holland between 1868 and 1883.

The most extensive tests were conducted by France (1873-1898) by the Commission d'Experience de Gavre (ref: Gen. Julian Hatcher, *Hatcher's Notebook*). Cranz also worked with the German service bullet shortly before World War I in Berlin.

Extensive work was performed by Russian Col. Mayevski using Krupp (German) firing tests from 1881. Mayevski's work became the cornerstone of modern ballistics. In the United States, U.S. Army Col. James Ingalls converted Mayevski's work to English units. Ingalls' ballistic tables were the mainstay for American ballistic research until the early 1960's.

A significant culmination of this international research saw the derivation of the ballistic coefficient (BC), which describes the bullet's ability to cut through the air. This factor, denoted "C" in mathematical equations, fully describes the bullet's flight characteristics. Tables such as the British (1909) and Ingalls may be used to determine the ballistic coefficient compared to the "standard" projectile used to develop the table.

When the ballistic coefficient and the muzzle velocity are known, most of the trajectory characteristics of the projectile may be found. As mentioned previously, the Speer tables have precalculated most of the pertinent values, letting the reader to choose the appropriate ballistic coefficient and muzzle velocity to look up the trajectory information.

The Speer tables and most other published charts are based on research undertaken at Winchester in the early 1960's that resulted in the G_1 tables. The G_1 tables generally match the earlier Ingalls' tables but with greater refinement and additional firing tests for different projectile shapes such as boat tails.

The following section is an example of what is required to use the G_1 tables. It is presented to show the effort saved by Speer's pre-worked tables or by ballistic software such as *PC Bullet*.

Table 1

Sample Space (S) and Time (t) Functions.

Velocity (ft/sec)	S_f feet	S_d feet	t_f sec	t_d sec
2900	5759.4	15.26	1.44	0.005
2950	5606.8	15.11	1.38	0.005
3000	5455.7	14.98	1.33	0.005
3050	5305.9	14.85	1.28	0.005
3100	5157.4	14.71	1.23	0.005
3150	5010.3	14.59	1.19	0.005
3200	4864.4	14.46	1.14	0.005
3250	4719.8	14.34	1.10	0.004
3300	4576.4	14.23	1.05	0.005
3350	4534.1	14.10	1.01	0.004
3400	4293.1	13.99	0.97	0.004
3450	4153.2	13.88	0.93	0.004
3500	4014.4	13.77	0.89	0.004

S_f = space function; S_d = space difference; t_f = time function; t_d = time difference

Tabular Methods

In this section, the use of drag tables will be briefly outlined. The drag tables used by *PC Bullet* were generated using the Runge-Kutta integration method, and to a much higher resolution than are the tables presented for the following example. Tables 1 and 2 are intended for instructional use only. The finer-resolution drag tables in *PC Bullet* have variable resolution with finer spacing in that portion of the G_1 curve where curvature is greater. This provides greater accuracy where it is needed.

Current ballistics software including *PC Bullet* employs tables of this format to perform ballistics calculations with great accuracy and speed. These tables do have their limitations, however. The tables used in PC Bullet were generated by ADC for level flight, and for standard atmospheric conditions. This gives accurate results for the majority of hunting and target shooting conditions. When shooting uphill or downhill, however, the drop from the bore axis, D(R), varies somewhat depending on the firing angle. This effect will be discussed later in this chapter.

Remaining velocity is determined by space and time functions. These functions are the heart of ballistic tables. Table 1 will supply the values for the example problem.

The following hypothetical example is based on a .308" Speer 180 grain boat tail bullet (ballistic coefficient equal to 0.54) leaving the muzzle at 3325 ft/s. For this example we'll use a range of 200 yards. The interpolation formula used to find the velocity, v_R, at range R for a bullet of ballistic coefficient C is:

$$S_f - \left(\frac{v_m - v_i}{5}\right)S_d + \frac{R}{C} = S_f' - \left(\frac{v_R - v_i}{5}\right)S_d' \quad \text{[Equation 1]}$$

The "unprimed" tabulated values (on the left of the equal sign) refer to the row containing the velocity that is just less than the muzzle velocity, v_m (v_i is the next smaller velocity listed in the table just below the actual value of v_m. The "primed" tabulated values (on the right of the equal sign) refer to those values corresponding to the velocity that is just less than the remaining velocity. In practice, one evaluates the left-hand-side (LHS) of Equation 1 and then finds the correct "primed row" by finding the S_f value that is just greater than the LHS value. For our example, the LHS reduces to

$$4576.4-\left(\frac{3325-3300}{5}\right)14.23+\left(\frac{3x200}{.54}\right)=5616.36$$

Note in Table 1 that both the "space function" and "space difference" columns are in units of feet, so that when the range is entered, the value 200 yards must be multiplied by three to get feet. This value (LHS=5616.36) is just less than S_f=5759.4 (but greater than S_f=5606.8), so S_f=5759.4 is the "primed row". Now we solve for v_R, the velocity at range R using the right-hand side of Equation 1:

$$v_R=2900+5\times\left(\frac{5759.4-5616.36}{15.26}\right)=2947\text{ ft / sec}$$

The next step is to compute the bullet's time-of-flight (TOF) to the range, R. The table interpolation formula using the time function and time difference columns is very similar to Equation 1:

$$t_f-\left(\frac{v_m-v_i}{5}\right)t_d+\frac{TOF}{C}=t'_f-\left(\frac{v_R-v'_i}{5}\right)t'_d \quad \text{[Equation 2]}$$

Simplifying and solving for TOF directly from Equation 2 produces the result:

$$TOF=0.54\times\left\{\left(1.44-\left(\frac{2947-2900}{5}\right)\times.005\right)-\left(1.05-\left(\frac{3325-3300}{5}\right)\times.005\right)\right\}$$

which simplifies to

$$TOF=.54\times(1.393-1.025)=0.199\text{ sec}$$

Now all we have to do is to calculate the drop from the bore axis. This value is calculated from tables by using a value, *F*, that is a function of the fraction that compares the remaining velocity at R to the muzzle velocity (i.e., v_R/v_m). Drop from bore is then calculated from:

$$D=F\times TOF^2$$

Table 2 contains this *F* data for our example. Because our velocity ratio is 2947/3325 = 0.8863, linear interpolation yields the result *F* = 185.32. The drop from bore at range R (200 yards) is therefore:

$$D_{200\text{yds}}=185.32\times(0.199)^2=7.34\text{ inches}$$

With a similar calculation carried out for the zero range, R_z, the bullet drop equation could then be used to obtain the relative bullet drop from the line of sight (LOS).

Table 2
F vs. Fractional Remaining Velocity

V_R/V_m	*F*
1.00	193
0.98	192
0.96	191
0.94	190
0.92	187
0.90	186
0.88	185
0.86	184

Table 3 contains results from *PC Bullet* v3.0 and direct numerical integration to compare with our sample hand calculations.

As you can see, it's certainly possible to perform these calculations for every load and each distance with a hand calculator. However, you would spend more time pushing buttons instead of shooting! That's where the power of the personal computer and ballistic software comes to the rescue.

Table 3 **Comparison Results**

Method	V_R, feet/sec	TOF(R), seconds	Drop, inches
Hand Calculation	2947.0	0.199	7.34
PC Bullet 3.0	2953.0	0.19	6.8
Euler Method	2952.0	0.19098	6.4485
Improved Euler	2952.8	0.19155	6.8193
4th-order Runge-Kutta	2952.8	0.19155	6.8185

Note: All integration methods used a time step of 0.01 seconds.

PC Bullet Software Methods

PC Bullet is the new ballistics software developed by ADC and marketed by Speer/RCBS. Currently in its third version, it includes many features that make doing ballistics analysis easy and fun. Extensive graphics capabilities, data management, and an easy-to-use menu-driven interface are the features that the user sees, but "under the hood" is a very accurate trajectory calculator (within the limitations of two-dimensional dynamics). As explained in the previous section, *PC Bullet* uses efficient, variable-resolution drag tables created on ADC's computers using the Runge-Kutta method. Execution speed is quite fast, even on older computers such as those using 8086 or 8088 processor chips.

One of the interesting features of *PC Bullet* is its ability to optimize a ballistic coefficient to a set of user-entered bullet drops (from LOS). The user enters muzzle velocity and zero range, and up to seven bullet drops. *PC Bullet* then uses a numerical iteration to find the BC that minimizes the sum square error (SSE) of calculated compared to measured bullet drops.

The following example shows this feature in action. A shooter chronographs his load and finds that the muzzle velocity is 3325 ft/sec. He then places paper targets at several ranges and fires a group at each range. He finds the center of each group and measures the distance from point-of-aim. He then inputs his data into *PC Bullet* and finds that the ballistic coefficient that best fits his data is 0.517. Knowing the effective BC, he can then use the software to predict his trajectory for any velocity and range he wishes.

Note that the BC determined by this method doesn't exactly match the published value of .540. The published value is obtained under optimum conditions; the value reported by *PC Bullet* represents the BC under the gun and environmental conditions at the time the shooter performed his tests.

Table 4
Bullet Drop Results for Sample Problem

Range, yards	Measured Path, inches	PC Bullet Predicted Path, inches
0	-1.5	-1.5
100	1.0	1.0
150	1.0	1.0
200*	0.0	0.0
250	-2.0	-2.0
300	-7.0	-5.1
400	-13.0	-14.8
500	-30.0	-29.5

*sight-in range

The Ballistic Coefficient

In the definitions at the beginning of this chapter, you saw that the ballistic coefficient is the sectional density (SD) divided by a form factor. Because the form factor is not easily obtained, the ballistic coefficient is normally found by experimental firings of the bullet. This requires measuring the velocity at the muzzle and at some known distance down range, or knowing the time-of-flight over the same distance. The greater the range separation, the better the resulting calculation of the ballistic coefficient.

It is also known that the ballistic coefficient is not constant but will vary with different velocities. For most uses, however, this adds needless complexity when the results using an average ballistic coefficient serve well enough.

Recall that the SD is the bullet weight in pounds divided by its diameter squared in inches. This can be easily calculated with the simplest hand calculator, or can be looked up in the reloading data. For the .308" 180 grain bullet we have used as an example, this value rounds off to .270 pounds per square inch.

Please notice that this is the sectional density for any .308" 180 grain bullet. It does not matter whether the bullet is round nose, spitzer or hollow point, made from lead or steel or built by Speer or any other firm. For the ballistic coefficient, however, the shape of the bullet plays a vital role.

Because the form factor of a bullet is hard to determine mathematically, firing tests determine the deceleration of the bullet and thereby calculate the corresponding ballistic coefficient. In order to compare form factors, however, we will back-figure using the published ballistic coefficients for several bullets. For consistency, all samples are .308", 150 grain bullets. Speer has four that we will use for comparison. They are listed below with the corresponding form factor. Recall that each has a sectional density of 0.226. Standard notation uses *i* as the form factor:

Flat Point	C = 0.268	*i* = 0.843
Grand Slam	C = 0.305	*i* = 0.741
Spitzer	C = 0.389	*i* = 0.581
Spitzer Boat Tail	C = 0.423	*i* = 0.534

Having the form factor "after the fact" is essentially useless except as a comparison. If it were known before knowing the ballistic coefficient then it would be useful. In the real world, shooting tests are easier and more reliable than trying to determine a form factor.

One concept that is often difficult to grasp is that the ballistic coefficient describes the projectile *regardless of its size*. The Speer .224" 70 grain semi-spitzer and the .458" 400 grain flat soft point both have a BC of .214. If the bullets are fired at 2200 feet/sec, their trajectories will be identical. Look at the Speer tables. Bullets are grouped by BC; size and other factors don't change the trajectory within the group.

Adjustment for Environmental Conditions

Let's say you're working up a load for an elk hunt in Colorado. You live in Florida near sea level and are developing the load in early spring when the temperature is around 70°F. Your guide in Colorado tells you that the area you'll hunt is at 9000 feet and to expect temperatures between 0 and 10°F. This drastic difference in environmental conditions is going to make a difference in point of bullet impact. What should you do?

We know that a sight-in test after reaching camp is called for, if only to make sure your scope didn't get knocked about in transit. However, computer owners can use *PC Bullet* to minimize the number of shots needed to verify the rifle's point of impact.

The published ballistic coefficients that you will find from various manufacturers are all based on standard atmospheric conditions. These conditions were established by the U.S. Army Ballistic Research Laboratory (BRL) at Aberdeen Proving Ground, Maryland. They are:

Altitude:	0 (Sea Level)
Temperature (T_{std}):	59° F
Pressure (P_{std}):	29.53 inches Hg
Relative Humidity:	78%
Air Density:	0.0751 lbs/cubic foot

In order to compute the effect that changing conditions have on the performance of any given bullet, we first have to calculate the *effective* ballistic coefficient, C_{eff}. This is the BC under the conditions of the hunt. The *Sierra Third Edition Reloading Manual* contains some very useful material on this subject, and the following formulae are taken from there. To adjust C for local conditions, the following correction formula is used:

$$C_{eff} = C_0\left(F_A\left(1 + F_T - F_P\right)F_{RH}\right)$$

where F_A, F_P, F_T and F_{RH} are functions of the altitude, pressure, temperature and relative humidity, respectively, and are defined by the following

$$F_P = \frac{P - P_{std}}{P_{std}} \quad \text{and} \quad F_T = \frac{T - T_{std}}{459.6 + T_{std}}$$

T and P are the actual local temperature and pressure. T_{std} and P_{std} are the "standard" temperature and pressure, respectively, for the local altitude. These values may be found tabulated as a function of altitude in several references, although we made life a little simpler for the user by reducing these tables to straight-forward correlations.

In the C_{eff} equation, F_{RH} is a function of the relative humidity and includes a factor for the vapor pressure of water. The vapor pressure of water is a tabulated function of local temperature, again reduced to a mathematical correlation. The correlations used by *PC Bullet* reproduce Sierra's tables and others to within very acceptable accuracy. The correlations for T_{std}, P_{std}, and F_A are:

$$T_{std} = 58.998529 - 0.003564A \text{ (in°F)}$$

$$P_{std} = 750.68279^{-3.75\times10^{-5}A} \text{(in mm Hg)}$$

and

$$F_A = 1.0000156^{3.021\times10^{-5}A}$$

where A is the altitude in feet in each function.

ADC has checked their correlations for these environmental adjustments with data generated by Sierra and other sources. In all cases the relationships are excellent. This means that the shooter using *PC Bullet* on his personal computer will get very accurate values when correcting for changes in the shooting environment.

It should be remembered that when the shooter manually adjusts the ballistic coefficient for ambient weather conditions, the only adjustment being made is to the external ballistics model. In reality, a change in temperature will also affect the muzzle velocity of the bullet. Temperature plays a key role in chemical reactions and the higher the temperature, the higher the muzzle velocity. The amount of change seen by any particular rifle and cartridge combination is hard to predict because too many factors enter the picture (powder type, bullet bearing surface, barrel length, etc.).

Experimental research indicates that 100 feet/sec per 50°F change in temperature may be expected for rifles, and 50 feet/sec per 50°F change in temperature for handguns. They emphasize that there was a high degree of variability in their data. Speer has a comprehensive table that allows the shooter to make approximate corrections for this effect. This data may be found in the reference section of this manual.

By entering a muzzle velocity corrected for temperature from these tables and then setting *PC Bullet* to use the expected temperature and altitude conditions of your hunt, you can predict the actual trajectory of your bullet under hunting conditions quite closely.

Shooting Uphill or Downhill

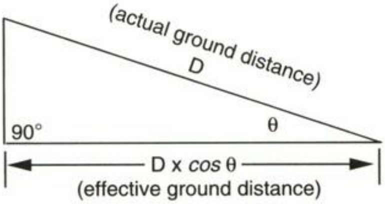
Shooting uphill or downhill presents new problems for the shooter. The bullet still behaves according to the physical laws of ballistics, but there will be an apparent change in the point of impact.

Because the ballistic tables were compiled using bullets fired parallel to the ground, shooting up or down hill adds trigonometric factors to the equations. Consider a simple triangle that has one 90° angle The lengths of the sides are related to the other two angles. For example the length of the sloped side (the hypotenuse) changes as you increase or decrease the angles at its ends.

In simple terms, this says that while the linear distance to the target may be 300 yards when firing uphill at 30°, the distance parallel to the ground will differ. The trig function used for this calculation is the *cosine*, whose values can be looked up in the trig tables in any high school math book. The cosine of 30° is 0.866. Multiplying 300 yards by 0.866 yields a ground distance of 259 yards. The bullet impacts as if it had traveled 41 yards *less*, and strikes higher than if it had traveled the full 300 yards. This is true if you were shooting 30° downhill as well. The rule, then, is to hold low when shooting up or down hill because the bullet impact will be higher than if the distance were horizontal.

Putting this another way, take the drop associated with the horizontal distance to the target and multiply the drop by the cosine of the shooting angle to get the actual drop. To illustrate this, as shown before, the horizontal distance for the 300 yard, 30° shot is 259 yards. The drop at 300 yards is 23.9 inches. The actual drop at the target is cos 30° × 23.9 inches, or .866 × 23.9, which gives 20.7 inches. This is 3.2 inches less than the horizontal 300 yards drop. You must then hold 3.2 inches low to get the expected hit at the 30° angle.

Here are multipliers to use for uphill/downhill corrections. To get the new drop, multiply the expected drop for a horizontal shot by the value shown.



Firing Angle	Multiplier
0°	1.000
10°	0.985
20°	0.940
30°	0.866
40°	0.766
50°	0.643

For those who are comfortable with math, here is a more advanced explanation of this phenomenon.

Firing Angle Adjustments: First-order effects

The most important factor to understand in shooting at an angle is that the drop (D) from the bore axis is always in the vertical direction. The bullet drop equation, however, was derived assuming that D was at right angles to the LOS. When shooting at some angle to the horizontal, θ, the bullet's impact point may still be found from the bullet drop equation, but the drop at range R, D_R, must be corrected. The vector component of D_R that is at right angles to the shooter's line of sight is reduced by a factor $(1-\cos\theta)$. The modified bullet drop equation becomes:

$$D_R = \frac{R}{R_{zero}}\left(D_{R_{zero}} + h_b\right) - \left(D_R \cos\theta + h_b\right)$$

where R_{zero} is the zero range and h_b is the height of the sights above the bore.

Second-order effects

There are also other effects that alter the bullet's point of impact when the shooter is firing uphill or downhill. These effects are gravitational potential energy and the variation in air density as the bullet changes altitude. The gravitational potential energy is the energy associated with the work required to lift the bullet up against gravity, or the "assist" that the bullet receives as it falls with gravity. Given the energies associated with modern firearms ammunition, this is indeed a very small factor. The other effect is the changing air density with altitude. If a bullet is fired uphill, it climbs into air that is less dense and therefore offers reduced drag. The converse is true for bullets fired downhill; the bullet dives into air that is of higher density. This, too, is a small effect but actually tends to cancel out the gravity effect. Including these effects in a detailed trajectory calculation will usually produce only a few percent change in the predicted impact point, even for firing angles up to 50°. In a drop of 27 inches, these combined effects may only make a difference of 0.3 to 0.5 inch. Thus they can be ignored for "real world" hunting situations at typical shooting distances.

Wind Adjustments

All shooters are aware that winds crossing the bullet's path can "blow" it off its normal point of impact. The effects of wind drift are not random, but can be mathematically defined just like any of the other factors we have discussed so far.

Crosswinds

In calculating wind drift from a two-dimensional model, researchers usually choose the lag-time model:

$$\text{Drift} = v_{cw}\left(\text{TOF} - \frac{R}{v_{muzzle}}\right)$$

In this model, TOF is the actual time of flight to a given range R, and v_{cw} is the perpendicular (90°) component of the crosswind velocity in feet/sec. If the time-of-flight is known, the drift can be determined on a hand calculator. Here is a simple example using the 200 yard data for the .308" 180 grain bullet used in earlier examples. Converting R to feet gives 600 feet. At our muzzle velocity of 3325 feet/sec with a 200 yard TOF of .199 second, a 30 mph (44 feet/sec) wind crossing at 90° would move the bullet

$$\text{Drift} = 44\left(.199 - \frac{600}{3325}\right) = 0.816 \text{ feet}$$

or just a little under 10 inches. Using *PC Bullet*, the computer owner can see the drift for different wind conditions and at various ranges. The software asks for both wind speed and its direction, so the program can automatically compensate for crosswinds other than those blowing at 90° to the bore. At a lesser angle, the effect of a 30 mph wind is less than at 90°.

Headwinds and Tailwinds

Headwinds and tailwinds are not a significant factor, especially as compared to crosswinds. A headwind causes a slight increase in drag on the bullet; a tailwind results in a slight decrease. The change in point of impact due to a crosswind may be on the order of ten times the magnitude of the change in point of impact from a similar headwind. Because they cause such a small variation, headwinds and tailwinds are not considered by PC Bullet when performing ballistic calculations.

Point Blank Range

Two very useful concepts in ballistics, especially for hunters, are point-blank range and maximum point-blank range.

The *point-blank range* of a given rifle/cartridge combination is the range out to which the shooter can aim "dead-on" and still be assured that the bullet will hit within some particular target radius. For example, if the point-blank range of a 30-06 is 350 yards for a 12-inch target, that means that the bullet drop (from LOS) is only 6 inches at 350 yards. The bullet would still hit within the target diameter. The target size, weapon's zero range, muzzle velocity, and the ballistic coefficient are all important factors in determining the point blank range. As the zero range is increased, the point blank range will also increase. However, there comes a point as the zero range is increased when the bullet path is so arched that the bullet will fly above the target radius for a part of its path as it nears the top of its ballistic arc.

This would not be desirable, and thus introduces the idea of the *maximum point-blank range* (MPBR). Think of it this way: let's assume that for deer hunting, you need a "kill zone" that is 12 inches in diameter. Now think of shooting down a long steel tube that is 12 inches across. Given your sight settings and load, what is the longest tube you can shoot through without having the bullet nick the top of the tube half-way down, or contact the bottom of the tube on the way out? The length of such a tube is equivalent to the maximum point-blank range. In the hunting field, a bullet that goes over the animal at the half-way point or under it beyond MBPR will mean an empty freezer unless the hunter makes additional hold corrections.

Some shooters assume that MPBR is a constant for a certain rifle. In reality, it also depends on the load and the target size. With the same load, the MPBR for a ground squirrel that's 5 inches tall is quite different for a mule deer with a 12 inch kill zone. Likewise, your 30 caliber rifle will have one MPBR for a 130 grain hollow point and another for a 180 grain round nose.

You can crudely figure out a MPBR by going out and shooting hundreds of rounds. However, there is an easier and more cost-effective solution. Ballistics programs like *PC Bullet* allow the shooter to input the target size and the program will calculate these specific values for each load you want to evaluate. The graphing features of *PC Bullet* clearly show when a bullet's path goes outside the target radius.

Bullet Energy

We have already discussed energy in Chapter 5. Recall that bullet energy is the energy of motion, or *kinetic energy*. Any object having mass (or weight) and motion has some amount of kinetic energy. Recall from the earlier chapter that energy is calculated from bullet weight and velocity.

Most hunters seldom consider energy as a factor. They assume that their firearm produces adequate energy for the task, which is usually the case. However, with the rising popularity of handgun hunting, the hunter may need to look at down-range energy. Some states have imposed hunting regulations specifying a minimum energy level for handgun hunting. If the regulation cites muzzle energy, chronographing the ammo and calculating the energy is fairly simple. On the other hand, some states have regulations requiring a minimum retained energy at some distance, usually 100 yards. To see if you are within the law, you can get this information from the Speer ballistics tables or from *PC Bullet* on your personal computer.

The Speer tables show a number listed as "Energy, ft-lb per grain" at various ranges. This is a pre-calculated value for the given velocity, assuming a bullet weighing one grain. First find the table for your bullet; they are ranked by BC. In the table find the muzzle velocity you are using and then select a range. In the box under that range you will see the energy number associated with the velocity. Multiply this number by the weight of your bullet to get energy at that distance.

For the 150 grain .308" bullet at 2800 feet/sec, the table shows the energy to be 17.41 ft-lbs per grain. Multiplying 17.41 by 150 yields a muzzle energy of 2,611.5 ft-lbs. Now look to the right until you find the 200 yard column. Under the heading there is the number 12.17. Multiplying by the bullet weight gives a 200 yards energy of 1825 ft-lbs. With these pre-calculated energy number in table form, finding the energy for the bullet at a given range becomes easy.

Chronographs

Velocity is an important factor in ballistics. Without knowing the velocity, virtually nothing else concerning the bullet path may be determined. In the past, instruments to measure bullet velocity were complicated and expensive. With modern electronics and the proliferation of computer technology, current chronograph prices put them easily in reach for most shooters. Chronographs range from the simplest that give only the velocity to sophisticated units with ballistics calculators built in. Oehler, PACT, Competition Electronics, Chrony and others now offer excellent chronographs priced within the means of most serious handloaders.

The typical chronograph will give you the velocity your firearm delivers for a particular load. With this, you can find the actual trajectory for that bullet. Because different guns can give different results with the same load, knowing your exact velocity will allow you to accurately predict trajectory.

For example, let's say you are shooting a 308 Winchester using the 150 grain spitzer. You know from the Speer Manual that the ballistic coefficient is .389, but in order to use the tables you need the bullet velocity. The Speer data lists the test gun as having a 22 inch barrel, but your gun is a carbine with an 18 inch barrel. This could mean that you are getting as much as 150 feet/sec less velocity from your gun than obtained in Speer's tests. Instead of 2800 feet/sec, your gun may only deliver 2650 feet/sec with the same load. Without a chronograph however, you simply do not know. For a 200 yard zero, you could be up to 2 inches off at 300 yards simply because of the lower velocity. This may seem trivial, but combined with all the other factors involved, it could be the difference between hitting and missing. Having access to a chronograph insures accurate point-of-impact information for your rifle.

Ballistic tables must be limited as to the velocity increments. If increments were 10 feet/sec, the tables would require a huge book to contain them. Typically tables are in increments of 100 feet/sec. Because most ballistic tables are general in nature, they may not specify the exact velocity you obtain from your gun. If your gun is posting an average velocity of 2650 feet/sec, you must interpolate between 2600 and 2700 feet/sec and, while not difficult, it does take some calculation. This is where ballistic software come into play. Computer programs for exterior ballistics such as *PC Bullet* allow using your own velocity data to look at the results from your gun and load.

More About *PC Bullet*

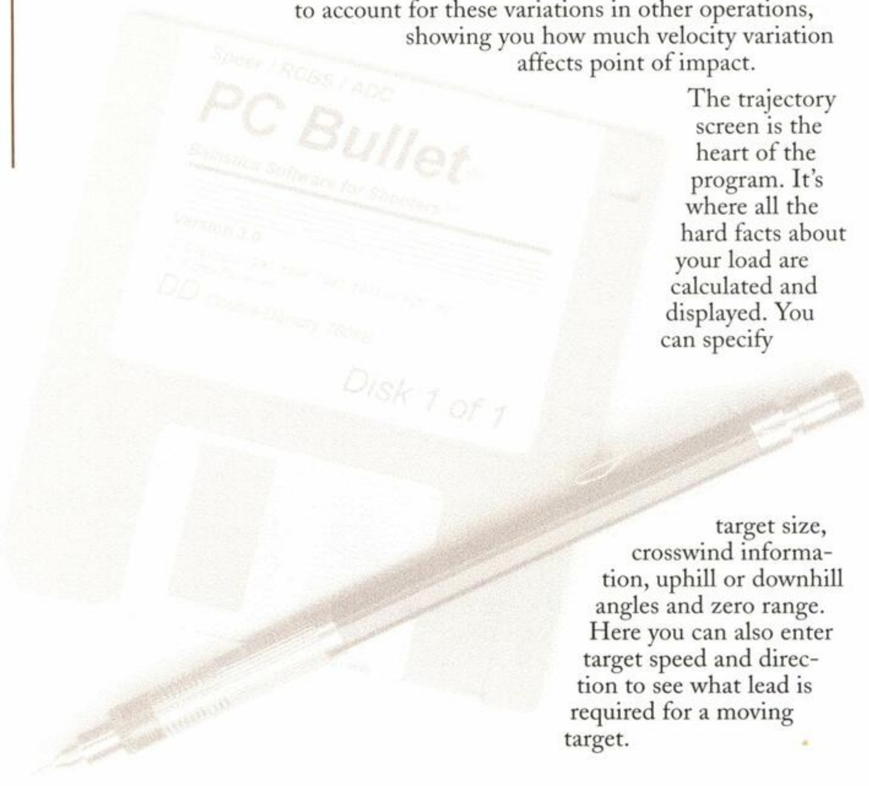
This chapter has mentioned some of the significant features and benefits of *PC Bullet* ballistics software. It is sophisticated, accurate and fast. But these aren't the only things that make this program so useful.

PC Bullet is easy to use. It features convenient pull-down menus for quick access to its functions. Data entry is simplified by the use of internal databases which store information about bullets, primers and propellants. Not only does the bullet database contain Speer bullets, but most other popular brands as well. If your favorite bullet isn't stored, you can quickly add it to the database for easy retrieval next time.

Once the load information is entered in the cartridge screen, it can be stored on your disk for future reference. So in addition to the trajectory uses of *PC Bullet*, you also have a computerized record of your loads. Each record occupies only about 7K of disk space, so hundreds of projects can be stored in your system.

The velocity screen allows quick entry of chronograph data. If you enter the individual shots instead of an average velocity, *PC Bullet* displays the statistics related to velocity variation. The software even knows to account for these variations in other operations, showing you how much velocity variation affects point of impact.

The trajectory screen is the heart of the program. It's where all the hard facts about your load are calculated and displayed. You can specify target size, crosswind information, uphill or downhill angles and zero range. Here you can also enter target speed and direction to see what lead is required for a moving target.



Remember our earlier example of preparing for a Colorado hunt? Well, it's here in the trajectory screen that you can enter the environmental conditions to predict the bullet path under a wide range of temperatures and altitudes. PC Bullet even corrects for muzzle velocity variation with temperature — automatically.

One of the handy features of this program is the ability to quickly perform "what if" analysis of your data. For example, you're looking at the trajectory screen for a load with a flat base bullet. How would the trajectory change if you switched to a boat tail bullet? A few keystrokes later, you'll see the appropriate changes on the screen. Many of the conditions of shooting can be manipulated this way in the program.

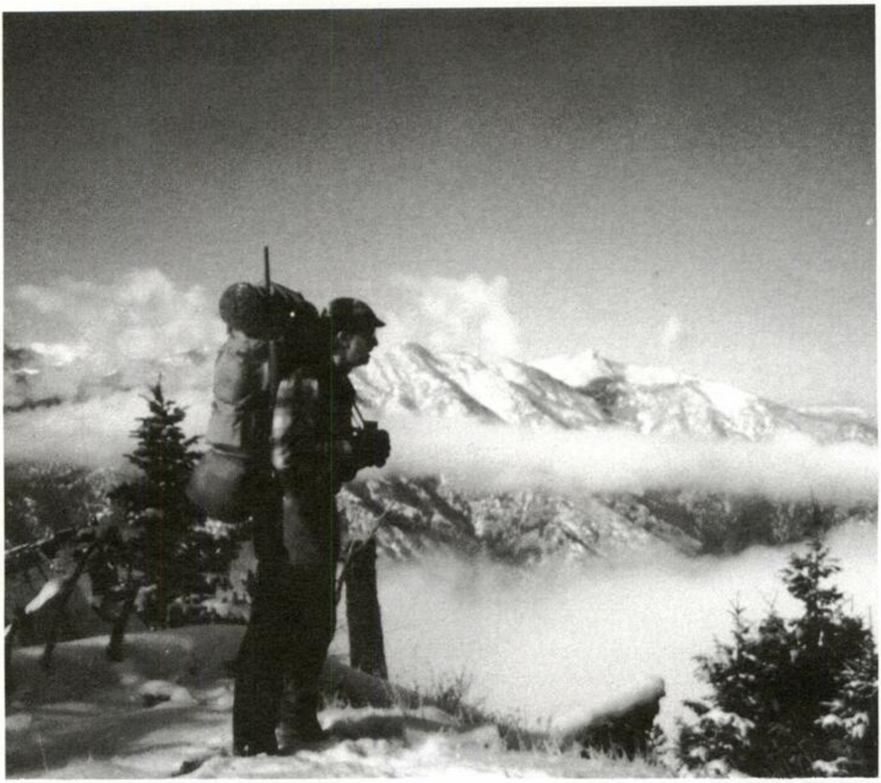
It's been said that a picture is worth a thousand words. With *PC Bullet* you can display graphs showing important information about your bullet's flight in nearly a dozen different formats. These can quickly highlight information that might not be obvious in a screen full of numbers. Have you ever wanted to compare the paths of several different cartridges or loads? In PC Bullet's graphing mode, you can overlay data from several files for direct visual comparison.

PC Bullet supports most popular printers including laser and ink-jet models, and can even output publication-quality PostScript® images for high-resolution electronic typesetting. You can print reports and graphs to file in notebooks.

PC Bullet runs on IBM and IBM-compatible computers with DOS 2.1 or higher operating systems. On more advanced systems, the software takes advantage of newer hardware for even faster performance.

Best of all, *PC Bullet* is affordable. For about the cost of three boxes of 30 caliber bullets, you can own a tool that will help you learn more about your firearms, their ammo and shooting in general. *PC Bullet* can help you be a better and more confident shooter.

To order PC Bullet, call RCBS at 800-533-5000.



Shooting sports offer the outdoorsman the opportunity to get out and enjoy all of the beauty mother nature has to offer. (Don Andersen)

INTRODUCTION TO THE RIFLE DATA

The following section contains reloading data for popular rifle cartridges. If you have used other Speer reloading manuals, you will notice some differences in the format.

First of all, you will notice that we have listed more propellants for popular cartridges than we did in earlier editions. This change was made to accommodate the many new propellants which have been introduced since 1987 when the Speer Manual #11 was published. To provide room for the extra propellant data, we have deleted the middle charge weight and velocity shown in previous Speer manuals. If you need to know the approximate velocity of the mid-point load, simply average the velocities for the starting and maximum load.

The second change is the ranking of the loads in the tables. In our previous publications, we ranked the loads from the heaviest charge weight to the lightest. The new tables are ranked by velocity, with the load producing the highest velocity in the upper left position.

Another change requested by many reloaders is the listing of the cartridge overall length (C.O.L) which we used in our testing. It is shown in the small table below the bullet illustrations. WE HAVE INCLUDED THIS FIGURE AS A REFERENCE POINT ONLY. YOUR RIFLE MAY REQUIRE A LONGER OR SHORTER LENGTH THAN SHOWN. Please refer to Chapter 7 for more information on bullet seating depths and techniques for rifle cartridges.

The last major difference in the tables is the indication of a compressed load. We now show a letter "C" behind the charge weight where compression of the propellant was necessary to assemble the load.

Using the Tables

There is a very simple rule for using the tables:

Always start with the minimum load!

All gun authorities recognize there are differences between individual firearms. The maximum loads shown were safe in the test equipment— both pressure barrels and production rifles— which we used during load development. However, your rifle may have some dimensional differences which could result in higher or lower operating pressures. Because you cannot know whether a pressure change will be up or down, using the starting load will give you the margin of safety required due to individual rifle variations. Starting loads are generally 8 to 12 percent below maximum, depending on the size of the case.

Maximum loads mean exactly that— MAXIMUM! Under no circumstances should you exceed these loads. They are presented to indicate the maximum performance potential for the cartridge; however, variations in individual rifles may not permit safely using them in every situation.

Here is the bottom line—read it twice: YOU MUST ALWAYS START WITH THE MINIMUM LOAD AND CAREFULLY WORK UP TOWARD THE MAXIMUM IN SMALL STEPS, WATCHING FOR PRESSURE SIGNS AT EACH STEP.

Changing Components

ANY change in components—primers, bullets or cases—from those listed requires that you return to the starting load and work up, just as with a new load. We also recommend that you note the propellant lot you are using in your reloading records. If you change lots when assembling maximum loads, we suggest you drop the charge one to two grains and fire several test rounds to make sure the load still is safe for your rifle. Once this is established, you can carefully work up toward the old load level. Modern propellant manufacturing techniques give remarkable lot-to-lot consistency but some minor variations may still occur. Speer has no control over the manufacturing practices of other component companies. This is another reason why we develop and emphasize beginning with starting loads.

NOTICE

THESE LOADS ARE FOR SPEER BULLETS. BULLETS OF OTHER MAKES WILL NOT PRODUCE THE SAME PRESSURES AND VELOCITIES.

ALL DATA CONTAINED HEREIN IS INTENDED FOR USE BY PERSONS FAMILIAR WITH HANDLOADING PRACTICES AND THEIR OWN LOADING EQUIPMENT. IF YOU ARE UNCERTAIN AS TO THE OPERATION OF YOUR EQUIPMENT, CONTACT THE EQUIPMENT MANUFACTURER FOR ADDITIONAL ASSISTANCE. NEW RELOADERS ARE STRONGLY URGED TO READ AND UNDERSTAND THE TEXT OF THIS MANUAL IN THE PRECEDING PAGES. IT HAS BEEN WRITTEN TO GIVE CLEAR INSTRUCTION IN THE PROCESSES USED IN RELOADING.

BECAUSE BLOUNT SPORTING EQUIPMENT DIVISION HAS NO CONTROL OVER INDIVIDUAL LOADING PRACTICES OR THE QUALITY OF THE FIREARMS IN WHICH THE RESULTING AMMUNITION MAY BE USED, NO RESPONSIBILITY—EITHER EXPRESSED OR IMPLIED—IS ASSUMED FOR THE USE OF THESE DATA.

THE DATA CONTAINED HEREIN REPLACES, SUPERCEDES AND OBSOLETES ALL DATA PREVIOUSLY PUBLISHED BY SPEER, OMARK INDUSTRIES AND BLOUNT, INC.

22 HORNET

Certain old cartridges never loose their charm and the tiny 22 Hornet is one of those. It evolved from an old black powder cartridge, the 22 WCF. Experimenters at Springfield Armory, including Col. Townsend Whelen and Capt. G. L. Wotkyns, developed the cartridge in M1922 Springfields converted from rimfire, and the Hornet was quickly picked up as a commercial item. Winchester produced the first 22 Hornet factory rifles and ammunition in the early 1930's.

The Hornet enjoyed immediate popularity as a medium-range varmint cartridge both in North America and Europe because its mild report made it especially suitable for use in settled areas. A number of quality rifles have been chambered for the Hornet since its introduction. The latest to reach the market is the Ruger M77/22, announced in 1994.

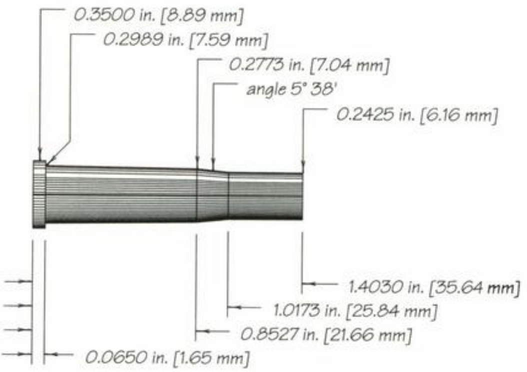
For small varmints out to 200 yards, the Hornet can hold its own. Because of its small case, rifles can be built on light, compact actions. The popularity of the Hornet in Europe remains quite high and a number of high-grade Hornet rifles are still produced there, including expensive rifle/shotgun combination guns.

Because of its moderate velocities and the relatively slow 1-in-16 inch rifling twist found in most production rifles, the Hornet shoots best with 40 and 45 grain bullets. Bullets heavier than 52 grains will not stabilize in most Hornet rifles. Factory ammunition is loaded with 45 grain bullets at about 2650 feet/sec.

The Hornet's case walls are quite thin and cases generally do not last as long as other centerfire cases. Inspect for incipient head separations after each firing and destroy any cases which are in questionable condition.

The industry maximum pressure for the Hornet has been reduced 4000 cup during the past few years. As a result, the only current propellant which consistently gave good velocities in our tests was AA 1680. Some powders now give velocities not much better than the 22 RF Magnum.

The industry maximum average pressure of the Hornet is 43,000 cup, and these loads are within those guidelines.


0.3500 in. [8.89 mm]
0.2989 in. [7.59 mm]
0.2773 in. [7.04 mm]
angle 5° 38'
0.2425 in. [6.16 mm]
1.4030 in. [35.64 mm]
1.0173 in. [25.84 mm]
0.8527 in. [21.66 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.403"
Trim-to Length: 1.393"
Max. Cart. Length: 1.723"
RCBS Shellholder: #12
Barrel Length: 24"
Twist: 1-16"

Test Firearm: Krico Target
Case: W-W
Primers: CCI 400

.224" Dia. **40 Grain** Sect. Density .114	**22** **Spire-SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	1.723"					
Speer Part No.	1017					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.5C**	**2749**	**IMR 4198**	**11.0C**	**2368**			
	11.5	2578		10.0	2075			
Viht. N110	**8.5**	**2457**	**AA 2015BR**	**12.0C**	**2142**			
	7.5	2200		11.0	1906			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.224" Dia. 45 Grain Sect. Density .128	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	1.723"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.5C**	**2651**	IMR 4198	**11.0C**	**2362**			
	11.5	2429		10.0	2165			
Viht. N110	**8.5**	**2422**	AA 2015BR	**12.0C**	**2089**			
	7.5	2113		11.0	1950			

.224" Dia. 50 Grain Sect. Density .142	22 Spitz-SP	22 TNT-HP				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	1.723"	1.723"				
Speer Part No.	1029	1030				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.0C**	**2495**	Viht. N110	**8.0**	**2197**	AA 2015BR	**11.5C**	**2048**
	11.0	2319		7.0	1948		10.5	1854
H110	**9.5**	**2418**	IMR 4198	**10.5C**	**2168**			
	8.5	2136		9.5	1991			

.224" Dia. 52 Grain Sect. Density .147	22 HP					
Ballistic Coefficient	0.225					
C.O.L. Tested At	1.723"					
Speer Part No.	1035					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**11.5**	**2395**	IMR 4198	**10.0C**	**2063**	296	**8.0**	**1994**
	10.5	2234		9.0	1974		7.0	1737
H110	**9.0**	**2325**	Viht. N110	**7.5**	**2060**	IMR 4227	**8.5**	**1953**
	8.0	2027		6.5	1820		7.5	1673

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

218 BEE

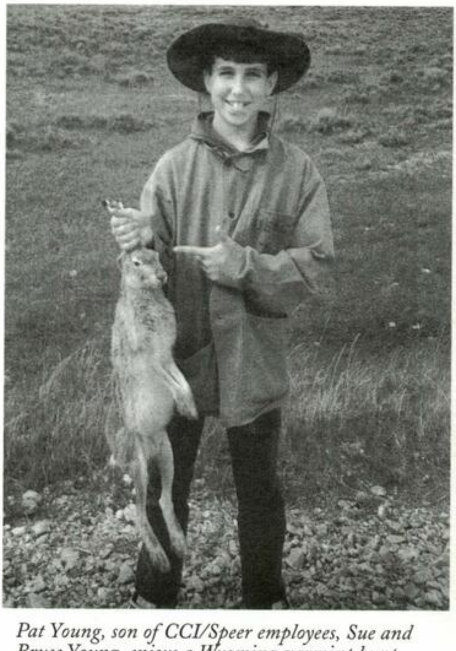
This cartridge appeared in 1938 as a small game and varmint cartridge in the Model 65 Winchester lever-action rifle. The Bee was conceived as an improvement over the popular 22 Hornet. Based on the 25/20 Winchester case, the Bee has more capacity than the Hornet. Factory ammo is cataloged at 2850 feet/sec with a 46 grain bullet. However, recent lots of ammunition often clock only between 2500 and 2700 feet/sec in production rifles.

The 218 Bee never achieved the popularity of other varmint cartridges, probably due to some less-than-accurate lever-action rifles in which it was originally chambered. In quality single-shot or bolt-action rifles, the Bee can give outstanding groups.

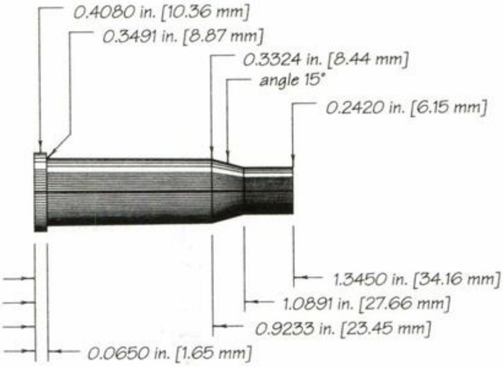
In 1989, Marlin and Browning reintroduced the 218 Bee in lever-action rifles and both rifles have sold well. These were the first production rifles for the 218 Bee since Kimber made a few bolt-action sporters several years ago. Because the new rifles have tubular magazines, Speer's 46 grain bullet for the Bee has a flat point for safety. DO NOT USE POINTED BULLETS IN RIFLES WITH TUBULAR MAGAZINES. Ruger announced the Bee in two rifles in 1993. The following data can be used with the 45 grain spitzer soft point bullet in single-shot and bolt-action rifles *only*.

Much of the older published data has not been pressure tested. We found that several powders such as 4227 and 2400, which have traditionally been considered good choices for Bee-class cartridges, fail to generate adequate velocities when normal working pressures are reached. Although a compressed load was used, IMR 4198 gave the best velocities, matching nominal factory ballistics in the Browning test rifle. Several groups shot under two minutes of angle using iron sights.

These loads do not exceed the SAAMI maximum average pressure of 40,000 cup. Like other small cartridges, the Bee is very sensitive to component substitutions. We strongly recommend that the listed loads be used exactly as shown.



Pat Young, son of CCI/Speer employees, Sue and Bruce Young, enjoys a Wyoming varmint hunt.


0.4080 in. [10.36 mm]
0.3491 in. [8.87 mm]
0.3324 in. [8.44 mm]
angle 15°
0.2420 in. [6.15 mm]
1.3450 in. [34.16 mm]
1.0891 in. [27.66 mm]
0.9233 in. [23.45 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.345"
Trim-to Length: 1.335"
Max. Cart. Length: 1.680"
RCBS Shellholder: #1
Barrel Length: 24"
Twist: 1-16"

Test Firearm: Browning M92
Case: W-W
Primers: CCI 400

.224" Dia. **46 Grain** Sect. Density .000	**22** **Flat-SP**					
Ballistic Coefficient	0.094					
C.O.L. Tested At	1.655"					
Speer Part No.	1024					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4198	**14.2C**	**2738**	**Viht. N110**	**9.2**	**2379**	**H110**	**9.0**	**2215**
	12.8	2466		8.3	2224		8.1	1959
AA 2460	**17.0C**	**2551**	**296**	**9.0**	**2325**	**2400**	**8.3**	**2151**
	15.3	2365		8.1	3161		7.5	1997
AA 1680	**12.0**	**2517**	**AA #9**	**8.7**	**2290**	**IMR 4227**	**9.8**	**2127**
	10.8	2329		7.8	2082		8.9	1914

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

222 REMINGTON

In 1950, Remington made history by introducing America's first true rimless, 22 caliber centerfire cartridge. First chambered in Remington's model 722 bolt action rifle, the "Triple-Deuce" used a totally new case design which wasn't based on any pre-existing cartridge. The cartridge's superb accuracy—not impressive velocity— made the 222 Remington an immediate success.

Firing a 50 grain bullet at 3100 feet/sec, the new cartridge was a natural for varmints. Fine accuracy, even from untuned factory rifles, attracted the attention of the benchrest fraternity. Competitors found that, in custom 222 rifles, one-hole groups were possible. This mild-mannered cartridge dominated benchrest competition for years. Its position was finally bettered in recent years by the PPC family of benchrest cartridges, but 222's are still found on the line today. Nearly every major rifle maker has chambered guns for the 222 Remington at one time or another.

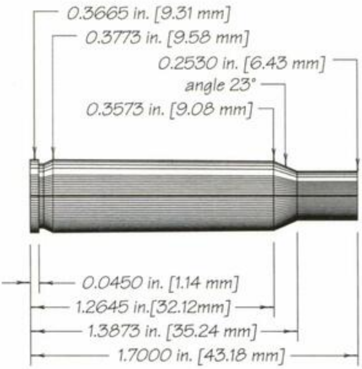
Today, the real appeal of the 222 is as a varmint cartridge. Its inherent accuracy gives it a useful range of around 250 yards—or somewhat more on still days. Best accuracy is usually obtained with bullets between 50 and 55 grains. Speer's 52 grain hollow point and 50 grain TNT™ hollow point give excellent accuracy and terminal performance. In fact, TNT was designed with the 222 Remington in mind. Its thin, fluted jacket gives explosive expansion usually seen only in higher velocity cartridges.

The 222 Remington is a reloader's dream. The long neck provides excellent bullet alignment and the small case means a pound of powder will last a long time.

Previous Speer manuals listed loads for the 70 grain semi-spitzer. However, they seldom showed satisfactory accuracy in many production rifles in this caliber. As a result, we decided to drop these loads. The 55 grain full metal jacket bullet can be loaded to around 2000 feet/sec for a turkey or pelt load. The modest velocity of the reduced load helps reduce damage to hides and edible meat.

The listed loads fall within the industry standard operating pressure of 46,000 cup.

The "War Wagon". The multi-level platform frames secured to the Jeep's roll cage offer several varmint hunters a firm shooting rest.


0.3665 in. [9.31 mm]
0.3773 in. [9.58 mm]
0.2530 in. [6.43 mm]
angle 23°
0.3573 in. [9.08 mm]
0.0450 in. [1.14 mm]
1.2645 in.[32.12mm]
1.3873 in. [35.24 mm]
1.7000 in. [43.18 mm]

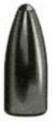
Max. Case Length: 1.700"
Trim-to Length: 1.690"
Max. Cart. Length: 2.130"
RCBS Shellholder: #10
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Remington 40-X
Case: R-P
Primers: CCI 400, 450

.224" Dia. **40 Grain** Sect. Density .114	**22** **Spire-SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	2.040"					
Speer Part No.	1017					

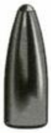
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**22.0**	**3617**	**H4198**	**21.5**	**3498**	**IMR 4895**	**25.0C**	**3432**
	20.0	3382		19.5	3306		23.0	3157
AA 2015BR	**24.0**	**3608**	**AA 2230***	**24.5**	**3465**	**748***	**25.0**	**3402**
	22.0	3301		22.5	3143		23.0	3079
AA 2460*	**25.5C**	**3581**	**AA 2520***	**26.0C**	**3447**	**Viht. N120**	**20.0**	**3395**
	23.5	3212		24.0	3299		18.0	3049
H322	**24.5**	**3538**	**Re12**	**26.0C**	**3446**	**H335***	**25.0**	**3382**
	22.5	3273		24.0	3084		23.0	3078
BL-C(2)*	**26.5C**	**3502**	**IMR 4198**	**21.0**	**3444**	**H4895**	**24.0C**	**3333**
	24.5	3236		19.0	3237		22.0	3000

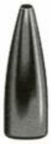
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.224" Dia. 45 Grain Sect. Density .128	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.130"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**26.5C**	**3498**	AA 2520*	**26.0C**	**3301**	748*	**25.0**	**3234**
	24.5	3148		24.0	3037		23.0	3008
AA 2460*	**25.0C**	**3431**	IMR 4198	**20.5**	**3278**	Viht. N120	**19.5**	**3216**
	23.0	3071		18.5	3032		17.5	2910
Re7	**21.5**	**3424**	H4198	**20.5**	**3267**	H4895	**24.0C**	**3215**
	19.5	3150		18.5	3038		22.0	2942
AA 2015BR	**23.0**	**3398**	Re12	**26.0C**	**3262**	H335*	**24.5**	**3211**
	21.0	3160		24.0	3017		22.5	3002
H322	**23.5**	**3338**	IMR 4895	**24.5C**	**3260**	AA 2230*	**23.0**	**3177**
	21.5	3154		22.5	3064		21.0	2891

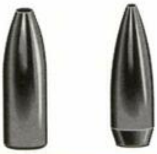




.224" Dia. 50 Grain Sect. Density .142	22 Spitz-SP	22 TNT-HP				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	2.110"	2.130"				
Speer Part No.	1029	1030				

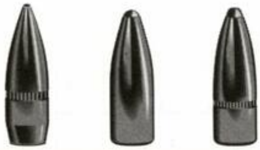
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**23.0**	**3345**	AA 2460*	**24.0**	**3224**	IMR 4198	**20.0**	**3135**
	21.0	3161		22.0	2892		18.0	2931
AA 2520*	**26.0C**	**3270**	IMR 3031	**23.0C**	**3199**	IMR 4320	**26.0C**	**3134**
	24.0	3130		21.0	2959		24.0	2945
BL-C(2)*	**26.0**	**3238**	AA 2230*	**23.5**	**3178**	Viht. N120	**19.0**	**3126**
	24.0	2992		21.5	2890		17.0	2808
Re7	**21.0**	**3237**	IMR 4895	**24.0C**	**3158**	H4198	**20.0**	**3109**
	19.0	3010		22.0	2874		18.0	2922
H322	**23.0**	**3225**	H4895	**24.0C**	**3156**	H335*	**24.0**	**3094**
	21.0	2967		22.0	2825		22.0	2800

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.224" Dia. **52 Grain** Sect. Density .147	**22** **HP**	**22** **HP-BT**				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.130"	2.130"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**26.0C**	**3374**	**H322**	**22.5**	**3256**	**AA 2230***	**23.0**	**3109**
	24.0	3020		20.5	2979		21.0	2922
AA 2520*	**26.0C**	**3337**	**IMR 3031**	**23.5C**	**3246**	**748***	**24.5**	**3106**
	24.0	3003		21.5	3035		22.5	2904
Viht. N133	**22.5C**	**3326**	**BL-C(2)***	**25.5**	**3233**	**H4198**	**19.5**	**3087**
	20.5	3077		23.5	2926		17.5	2917
IMR 4895	**24.5C**	**3279**	**AA 2460***	**23.5**	**3185**	**H335***	**23.5**	**3064**
	22.5	3049		21.5	2930		21.5	2880
H4895	**24.0**	**3277**	**Re7**	**20.0**	**3115**	**IMR 4198**	**19.5**	**3050**
	22.0	3048		18.0	2835		17.5	2821



.224" Dia. **55 Grain** Sect. Density .157	**22** **FMJ-BT**	**22** **Spitz-SP**	**22** **Spitz-SP**			
Ballistic Coefficient	0.269	0.255	0.241			
C.O.L. Tested At	2.130"	2.130"	2.130"			
Speer Part No.	1044	1047	1049			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**26.0C**	**3264**	**Viht. N133**	**22.0**	**3132**	**748***	**24.5**	**3035**
	24.0	2921		20.0	2866		22.5	2838
AA 2520*	**26.0C**	**3235**	**AA 2460***	**23.5**	**3106**	**IMR 4064**	**23.5C**	**3033**
	24.0	2912		21.5	2826		21.5	2775
H4895	**24.0C**	**3159**	**IMR 3031**	**23.0C**	**3083**	**IMR 4320**	**25.0C**	**3020**
	22.0	2906		21.0	2836		23.0	2794
H322	**22.5**	**3145**	**BL-C(2)***	**25.0**	**3072**	**IMR 4198**	**19.5**	**2999**
	20.5	2909		23.0	2780		17.5	2804
IMR 4895	**24.0C**	**3142**	**Re7**	**20.0**	**3045**	Reduced Load **SR 4759**	**10.0**	**2070**
	22.0	2969		18.0	2832		8.0	1662

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

223 REMINGTON (5.56mm NATO)

The 223 Remington resulted from military development of a new service rifle cartridge. Adopted in February, 1964 as the 5.56mm Ball Cartridge M193, it was introduced as a commercial cartridge by Remington one month earlier.

Based on the 222 Remington case head dimensions, the 223 case is only .060" longer than its parent. However, it has greater powder capacity because the case body was lengthened and the neck shortened. With equivalent bullet weights, the 223 enjoys a 100 to 300 feet/sec velocity advantage. This advantage is due to a combination of the larger case and higher operating pressures.

Almost any military cartridge, once commercialized, is destined to become an immediate success and the 223 was no exception. The ready supply of cases and an excellent selection of 22 caliber bullets has made the 223 one of our most popular cartridges. It has also found wide acceptance as a police cartridge.

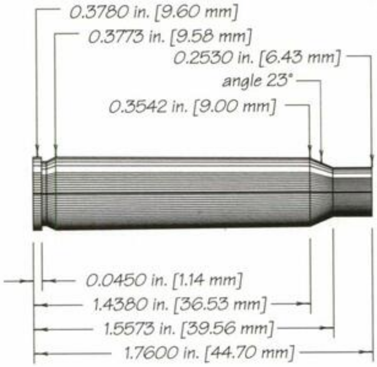
Original military and commercial rifles had a 1-in-14 inch rifling twist, later changed to 1-in-12 inches for better long-range stability with the 55 grain service bullet. However, when the military adopted a heavier, 62 grain service round, military rifles were fitted with 1-in-7 inch twist barrels to handle the new bullet. Several commercial makers of semi-automatic rifles followed suit and changed to the faster twist.

Although the fast twist works well with military ammo, handloaders ran into a problem. Most 22 caliber centerfire rifle bullets are of light construction for varmint hunting. When fired at 3200 feet/sec in a 1-in-7 twist rifle, the bullet is rotating at over 300,000 rpm when it leaves the muzzle. This rotation is more than most varmint bullets can withstand so they are literally ripped apart as they leave the barrel.

If you have a rifle with the faster 1-in-7 twist, you should limit muzzle velocity of sporting-type bullets to around 2800 feet/sec. Speer sells a 62 grain FMJ-BT bullet which is a duplicate of the bullet in the new M855 service cartridge. The Speer 70 grain semi-spitzer is also a good bullet in the fast-twist rifles; however, be sure to watch overall length, as the long bullet can stick in the throat if seated too long. Some rifle makers recommend that bullets be crimped if used in their semi-automatic rifles. Three Speer 22 caliber bullets feature a cannelure for easy crimping. The 62 grain FMJ-BT will give mediocre accuracy in 1-in-12 inch barrels, and should be restricted to rifles with 10 inch or faster rifling twists.

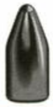
The commercial IMI cases used for our tests are built to the same specification as military cases, so load reduction is not required when using surplus military brass with these loads. Remember that military cases have crimped primers. The crimp MUST be removed before re-priming.

The commercial 223 pressure limit is 52,000 cup. These loads do not exceed that limit.


0.3780 in. [9.60 mm]
0.3773 in. [9.58 mm]
0.2530 in. [6.43 mm]
angle 23°
0.3542 in. [9.00 mm]
0.0450 in. [1.14 mm]
1.4380 in. [36.53 mm]
1.5573 in. [39.56 mm]
1.7600 in. [44.70 mm]

Max. Case Length: 1.760"
Trim-to Length: 1.750"
Max. Cart. Length: 2.260"
RCBS Shellholder: #10
Barrel Length: 22"
Twist: 1-12"

Test Firearm: Ruger 77 Mk II
Case: IMI
Primers: CCI 400, 450*



.224" Dia. **40 Grain** Sect. Density .114	**22** **Spire-SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	2.060"					
Speer Part No.	1017					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**30.0C**	**3557**	**IMR 3031**	**27.0C**	**3410**	**H4198**	**22.5**	**3342**
	28.0	3339		25.0	3032		20.5	2981
Viht. N133	**25.0C**	**3486**	**H322**	**26.0**	**3388**	**BL-C(2)***	**28.0**	**3315**
	23.0	3139		24.0	3027		26.0	3064
AA 2015BR	**25.5**	**3461**	**AA 2230**	**26.0**	**3361**	**H4895**	**25.5C**	**3297**
	23.5	3068		24.0	3062		23.5	2954
AA 2460*	**26.5**	**3445**	**Re12**	**27.0C**	**3342**	**H335***	**28.5**	**3133**
	24.5	3086		25.0	3030		26.5	2903

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. **45 Grain** Sect. Density .128	**22** **Spitz-SP**					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.155"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**27.0C**	**3404**	**IMR 3031**	**27.0C**	**3337**	**BL-C(2)***	**28.0C**	**3219**
	25.0	3098		25.0	3070		26.0	2897
748*	**29.0C**	**3396**	**AA 2460***	**26.0**	**3275**	**AA 2230**	**25.5**	**3156**
	27.0	2988		24.0	2948		23.5	2777
IMR 4198	**23.0**	**3377**	**Viht. N133**	**24.5C**	**3263**	**Re12**	**26.5C**	**3062**
	21.0	3066		22.5	2969		24.5	2817
H322	**26.0**	**3362**	**AA 2015BR**	**25.0**	**3260**	**H335***	**27.0C**	**3020**
	24.0	2959		23.0	2901		25.0	2688

.224" Dia. **50 Grain** Sect. Density .114	**22** **Spitz-SP**	**22** **TNT-HP**				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	2.185"	2.235"				
Speer Part No.	1029	1030				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**28.5**	**3398**	**AA 2015BR**	**24.5**	**3266**	**H4198**	**22.0**	**3178**
	26.5	3083		22.5	2951		20.0	2850
AA 2520*	**28.0C**	**3328**	**H335***	**27.0**	**3262**	**AA 2230**	**25.0**	**3138**
	26.0	3178		25.0	2975		23.0	2847
IMR 4895	**27.0C**	**3313**	**Viht. N133**	**24.0**	**3237**	**IMR 4320**	**27.0C**	**3067**
	25.0	3028		22.0	2899		25.0	2796
H322	**26.0**	**3300**	**H4895**	**25.5C**	**3203**	**H380***	**28.0C**	**2851**
	24.0	3001		23.5	2871		26.0	2676
IMR 3031	**26.0C**	**3284**	**BL-C(2)***	**27.5**	**3200**			
	24.0	2969		25.5	2961			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia.
52 Grain
Sect. Density .114

	22 HP	22 HP-BT				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.200"	2.200"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**28.0C**	**3448**	**H4895**	**25.5C**	**3146**	**AA 2460***	**25.0**	**3056**
	26.0	3138		23.5	2863		23.0	2750
IMR 4895	**26.5C**	**3202**	**H335***	**26.5**	**3129**	**Re7**	**20.5**	**2931**
	24.5	2850		24.5	2879		18.5	2609
IMR 3031	**26.0C**	**3195**	**H322**	**24.5**	**3101**	**IMR 4320**	**26.0C**	**2893**
	24.0	2876		22.5	2822		24.0	2546
Viht. N133	**24.0**	**3175**	**IMR 4064**	**26.0C**	**3087**	**Olin 760***	**28.0C**	**2882**
	22.0	2826		24.0	2840		26.0	2594
Re15	**27.0C**	**3170**	**BL-C(2)***	**27.0**	**3062**			
	25.0	2790		25.0	2695			

.224" Dia.
55 Grain
Sect. Density .114

	22 FMJ-BT	22 Spitz-SP	22 SP/Cann.			
Ballistic Coefficient	0.269	0.255	0.241			
C.O.L. Tested At	2.215"	2.175"	2.215"			
Speer Part No.	1044	1047	1049			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**28.0C**	**3313**	**H322**	**24.5**	**3158**	**Viht. N135**	**25.0C**	**3086**
	26.0	2965		22.5	2823		23.0	2787
AA 2230	**25.0**	**3233**	**IMR 4064**	**26.5**	**3143**	**AA 2460***	**25.0**	**3079**
	23.0	3017		24.5	2843		23.0	2832
IMR 3031	**26.0C**	**3223**	**BL-C(2)***	**27.0**	**3138**	**AA 2015BR**	**23.5**	**3026**
	24.0	2976		25.0	2868		21.5	2753
H4895	**25.5C**	**3194**	**H335***	**26.0**	**3092**	**H4198**	**21.0**	**2978**
	23.5	2908		24.0	2805		19.0	2693
AA 2520*	**27.0C**	**3187**	**Viht. N133**	**23.5**	**3091**	**Re12**	**25.0C**	**2960**
	25.0	3021		21.5	2775		23.0	2711

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Notes: Not recommended for rifles with 1-in-12 inch twists.

.224" Dia. 62 Grain

Sect. Density .177

	22 FMJ-BT					
Ballistic Coefficient	0.307					
C.O.L. Tested At	2.255"					
Speer Part No.	1050					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2520*	**26.5C**	**3025**	**IMR 4064**	**25.5C**	**2942**	**AA 2015BR**	**22.5**	**2973**
	24.5	2875		23.5	2661		20.5	2509
AA 2460*	**24.5**	**2966**	**748***	**25.5**	**2945**	**Re15**	**25.0C**	**2955**
	22.5	2636		23.5	2556		23.0	2549
Viht. N133	**23.0**	**2948**	**H335***	**25.0**	**2946**	**IMR 4320**	**25.5C**	**2867**
	21.0	2646		23.0	2625		23.5	2568
AA 2230*	**24.0**	**2975**	**H4895**	**24.0**	**2873**	**BL-C(2)***	**25.0**	**2907**
	22.0	2642		22.0	2539		23.0	2476
IMR 4895	**24.5C**	**2940**	**Viht. N135**	**24.0**	**2889**	**IMR 3031**	**23.5C**	**2913**
	22.5	2548		22.0	2590		21.5	2466

.224" Dia. 70 Grain

Sect. Density .199

	22 Semi Spitz-SP					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.140"					
Speer Part No.	1053					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**27.0**	**3068**	**AA 2460**	**23.5**	**2778**	**IMR 4320**	**24.5**	**2644**
	25.0	2824		21.5	2500		22.5	2450
H414*	**28.0**	**2883**	**AA 2230**	**23.0**	**2715**	**Re12**	**22.0**	**2635**
	26.0	2658		21.0	2464		20.0	2476
IMR 4895	**24.5C**	**2826**	**H380***	**28.0**	**2700**	**BL-C(2)***	**23.5**	**2618**
	22.5	2628		26.0	2533		21.5	2450
H335*	**24.5**	**2812**	**Viht. N135**	**22.5**	**2661**	**AA 2015BR**	**20.0**	**2555**
	22.5	2592		20.5	2425		18.0	2328

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

222 REMINGTON MAGNUM

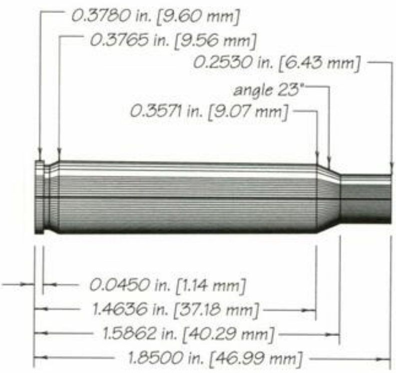
The 222 Remington Magnum, like the 223 Remington, started life as an experimental military cartridge. When the 222 Magnum was not adopted by the military, Remington introduced it as a commercial cartridge. Like the 223, the 222 Magnum was based on the excellent 222 Remington case. The Magnum case is longer than the 223 (mostly in the neck) and case capacity is 20 percent greater than the 222 Remington, and about 5 percent greater than the 223. The Magnum version is loaded to slightly lower pressure than the 223, so actual performance of the two cartridges is virtually the same.

When the 222 Remington Magnum was first introduced in 1958, a number of firms chambered rifles for it. However, when the 223 Remington was announced in 1964, most of these companies dropped the Magnum in favor of the commercial version of the new service cartridge.

The 222 Remington Magnum was and still is an excellent varmint cartridge. There is no reason to trade a good 222 Magnum rifle for a 223. However, it will be hard to find a new rifle in this caliber unless it is special-ordered or built as a custom project. At press time, only Steyr-Mannlicher and Wichita Precision rifles are chambered for this cartridge.

Operating pressures for the 222 Remington Magnum are 50,000 cup. As usual, approach all maximum loads with caution.

222 REMINGTON MAGNUM


0.3780 in. [9.60 mm]
0.3765 in. [9.56 mm]
0.2530 in. [6.43 mm]
angle 23°
0.3571 in. [9.07 mm]
0.0450 in. [1.14 mm]
1.4636 in. [37.18 mm]
1.5862 in. [40.29 mm]
1.8500 in. [46.99 mm]

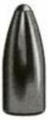
Max. Case Length: 1.850"
Trim-to Length: 1.840"
Max. Cart. Length: 2.280"
RCBS Shellholder: #10
Barrel Length: 23.75"
Twist: 1-12"

Test Firearm: SAKO
Case: R-P
Primers: CCI 400, 450*

.224" Dia. **40 Grain** Sect. Density .114	**22 Spire-SP**				
Ballistic Coefficient	0.144				
C.O.L. Tested At	2.200"				
Speer Part No.	1017				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**29.0**	**3720**	IMR 3031	**27.0**	**3622**	IMR 4064	**28.0**	**3489**
	27.0	3429		25.0	3370		26.0	3255
IMR 4320	**29.0**	**3692**	BL-C(2)*	**28.0**	**3587**	Reduced Load SR 4759	**10.0**	**1912**
	27.0	3450		26.0	3309		8.0	1541
748*	**31.0**	**3660**	IMR 4198	**23.5**	**3540**			
	29.0	3404		21.5	3251			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

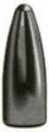


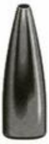
.224" Dia.
45 Grain

Sect. Density .128

	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.220"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**29.0**	**3661**	**IMR 3031**	**27.0**	**3524**	**Re7**	**23.5**	**3348**
	27.0	3390		25.0	3269		21.5	3077
748*	**30.0**	**3653**	**IMR 4198**	**23.5**	**3488**	Reduced Load **SR 4759**	**10.5**	**1986**
	28.0	3389		21.5	3197		8.5	1607
IMR 4320	**29.0**	**3561**	**IMR 4895**	**27.0**	**3396**			
	27.0	3332		25.0	3161			





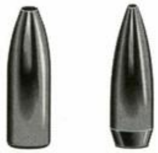
.224" Dia.
50 Grain

Sect. Density .142

	22 Spitz-SP	22 TNT-HP				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	2.250"	2.250"				
Speer Part No.	1029	1030				

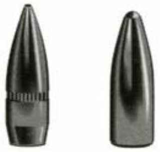
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**28.5**	**3514**	**IMR 4064**	**28.0**	**3414**	**H414***	**31.0**	**3381**
	26.5	3243		26.0	3190		29.0	3133
IMR 4320	**29.0**	**3482**	**BL-C(2)***	**27.0**	**3398**	Reduced Load **SR 4759**	**11.0**	**2075**
	27.0	3255		25.0	3137		9.0	1690
IMR 4198	**23.0**	**3415**	**IMR 3031**	**26.5**	**3396**			
	21.0	3132		24.5	3149			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.224" Dia. **52 Grain** Sect. Density .147	**22** **HP**	**22 BT** **HP-Match**				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.250"	2.250"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**28.0**	**3480**	**IMR 3031**	**26.5**	**3421**	**H414***	**31.0**	**3294**
	26.0	3225		24.5	3171		29.0	3060
BL-C(2)*	**26.5**	**3458**	**IMR 4064**	**28.0**	**3415**	**Re7**	**22.0**	**3220**
	24.5	3181		26.0	3189		20.0	2930
IMR 4320	**29.0**	**3446**	**IMR 4895**	**27.0**	**3330**			
	27.0	3222		25.0	3098			



.224" Dia. **55 Grain** Sect. Density .157	**22 BT** **FMJ**	**22** **Spitz SP**				
Ballistic Coefficient	0.189	0.255				
C.O.L. Tested At	2.250"	2.250"				
Speer Part No.	1044	1047				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**27.5**	**3343**	**IMR 4064**	**27.5**	**3294**	**H414***	**31.0**	**3223**
	25.5	3084		25.5	3077		29.0	2983
IMR 4320	**28.0**	**3311**	**IMR 3031**	**26.0**	**3290**	Reduced Load **SR 4759**	**11.0**	**2066**
	26.0	3085		24.0	3053		9.0	1694
BL-C(2)*	**26.5**	**3295**	**IMR 4895**	**26.5**	**3275**			
	24.5	3038		24.5	3040			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. **70 Grain** Sect. Density .199	**22 Semi Spitz-SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.260"					
Speer Part No.	1053					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**26.5**	**3043**	**H335***	**25.0**	**2938**	**H380**	**29.0**	**2850**
	24.5	2820		23.0	2681		27.0	2617
IMR 4320	**26.5**	**2983**	**IMR 3031**	**24.0**	**2880**	Reduced Load **SR 4759**	**12.0**	**1925**
	24.5	2777		22.0	2655		10.0	1615
IMR 4895	**25.0**	**2938**	**H414***	**28.0**	**2873**			
	23.0	2723		26.0	2651			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

22 PPC

The 22 PPC is a wildcat cartridge for benchrest competition developed by Dr. Lou Palmisano and gunsmith Ferris Pindell in 1975. They started with an obscure target cartridge called the 220 Russian. That was based on the 7.62x39mm Eastern Bloc service cartridge.

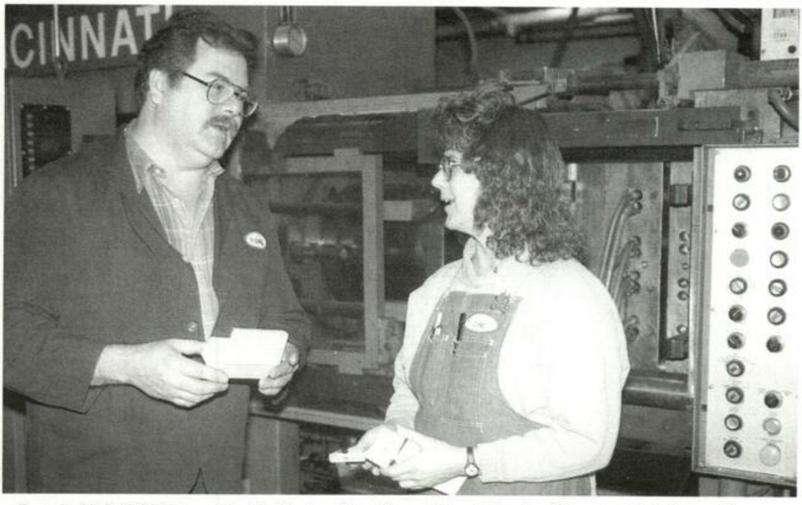
Palmisano and Pindell modified the Russian cartridge by reducing case taper to 10° and increasing the shoulder angle to 30°. The new design also incorporated a small primer pocket with a smaller flash hole (.066") than is normally used in centerfire cases. The short, stubby case was perfectly suited to the ignition power provided by a small rifle primer.

In its first year, the 22 PPC racked up an impressive series of benchrest titles and its incredible accuracy quickly dethroned that old benchrest favorite, the 222 Remington. Its efficient design also makes the 22 PPC a very potent varmint cartridge, falling somewhere between the 223 and the 22-250.

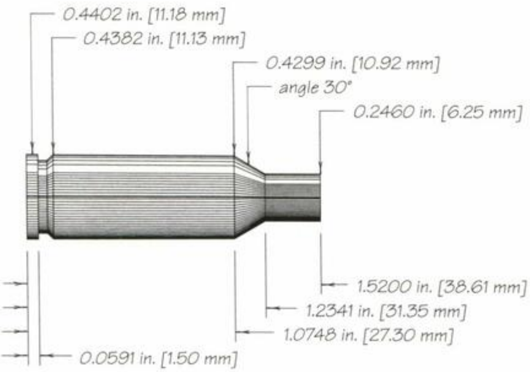
Sako imports 22 PPC rifles and brass and Wichita Precision builds rifles in this caliber, as do a number of other custom gunsmiths. Ruger has also chambered varmint rifles for the PPC. While working with the 22 PPC, Palmisano and Pindell also developed the 6mm PPC on the same basic case.

Because this is a wildcat cartridge, no industry pressure standards exist. The late Dan Pawlak did pressure research on this cartridge using electronic transducer equipment. According to his research, the loads listed here should not exceed 55,000 psi. However, because of variations in individual rifles, use great care in working up maximum loads.

Benchrest rifles in this caliber are typically built with very tight throats and necks. Turning case necks is mandatory in these rifles and failing to perform this operation can result in excessive pressures.



Randy Holt, CCI/Speer Plastics Supervisor (l) and Lou Marvin, Operator (r) discuss Speer bullet packaging.


0.4402 in. [11.18 mm]
0.4382 in. [11.13 mm]
0.4299 in. [10.92 mm]
angle 30°
0.2460 in. [6.25 mm]
1.5200 in. [38.61 mm]
1.2341 in. [31.35 mm]
1.0748 in. [27.30 mm]
0.0591 in. [1.50 mm]

Max. Case Length: 1.520"	**Test Firearm:** Pindell-Wichita
Trim-to Length: 1.510"	**Case:** SAKO
Max. Cart. Length: N/A	**Primers:** CCI BR-4
RCBS Shellholder: #32	
Barrel Length: 24"	
Twist: 1-14"	

.224" Dia. **52 Grain** Sect. Density .147	**22 HP**	**22 BT HP-Match**				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.040"	2.050"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)	**28.5C**	**3550**	**Re7**	**24.0**	**3327**	**IMR 4895**	**27.0C**	**3237**
	26.5	3277		22.0	3064		25.0	3010
H335	**28.0C**	**3491**	**IMR 4198**	**23.5**	**3323**	**IMR 3031**	**26.0C**	**3221**
	26.0	3230		21.5	3053		24.0	2993
H322	**27.0C**	**3393**	**748**	**30.0C**	**3321**			
	25.0	3155		28.0	3082			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia.
55 Grain

Sect. Density .157	**22 Spitz-SP**					
Ballistic Coefficient	0.255					
C.O.L. Tested At	2.050"					
Speer Part No.	1047					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)	**28.0C**	**3392**	**Re7**	**24.0**	**3277**	**IMR 4895**	**27.0C**	**3186**
	26.0	3150		22.0	3019		25.0	2966
H335	**28.0C**	**3339**	**748**	**29.5C**	**3228**	**IMR 4198**	**23.0**	**3174**
	26.0	3101		27.5	2990		21.0	2914
H322	**27.0C**	**3322**	**IMR 4320**	**28.0C**	**3203**			
	25.0	3093		26.0	2994			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

225 WINCHESTER

In 1964, Winchester announced the somewhat odd-looking 225 cartridge to replace the aging 220 Swift. They chambered the revamped Model 70 bolt action in both sporter and varmint models for the new cartridge.

The 225 is officially designated as a semi-rimmed case; however, the rim is quite large for its type. There was a good reason for this rim—it is exactly the same as the 30-06 rim diameter and it feeds just like a rimless cartridge from box magazines. Even though rifles with standard bolt faces could easily be chambered for the new cartridge, it was the pressure of Winchester's competition, not technical problems, which kept the 225 from becoming a popular rifle.

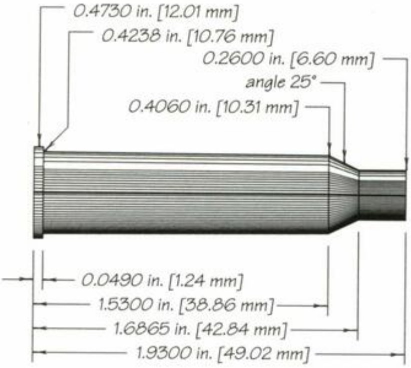
Just a year after the 225 was introduced, Remington announced that it was going to commercialize the 22-250, one of the most popular wildcat cartridges ever. The 22-250 was a more conventional design with an established reputation for long-range varmint performance and accuracy so other gun makers opted to chamber for the 22-250 instead. With the exception of the Savage Model 340, no other commercial rifle was ever chambered for it. In one of the great ironies of the shooting industry, the 225 Winchester is facing obsolescence while the cartridge it was supposed to replace, the 220 Swift, is making a strong comeback.

We hope that Winchester maintains a supply of 225 brass. The strong case is the basis for several excellent proprietary handgun cartridges designed by J. D. Jones at SSK Industries.

Loading the 225 is simple and straight-forward. Any .224" bullet can be used, and it generates enough velocity to stabilize the long 70 grain Speer semi-spitzer. Best accuracy is obtained with 50, 52 and 55 grain bullets.

The industry maximum pressure for the 225 Winchester is 50,000 cup; these loads do not exceed that level.

Dan Nicklaus, CCI/Speer Operator, monitoring one of the the assembly presses.


0.4730 in. [12.01 mm]
0.4238 in. [10.76 mm]
0.2600 in. [6.60 mm]
angle 25°
0.4060 in. [10.31 mm]
0.0490 in. [1.24 mm]
1.5300 in. [38.86 mm]
1.6865 in. [42.84 mm]
1.9300 in. [49.02 mm]

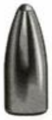
Max. Case Length: 1.930"
Trim-to Length: 1.920"
Max. Cart. Length: 2.500"
RCBS Shellholder: #11
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Winchester Model 70
Case: W-W
Primers: CCI 200, 250*

.224" Dia. **40 Grain** Sect. Density .114	**22** **Spire-SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	2.370"					
Speer Part No.	1017					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**32.5**	**3815**	**748***	**35.0**	**3711**	**IMR 4350**	**37.0C**	**3614**
	28.5	3391		31.0	3310		33.0	3273
IMR 4064	**34.5**	**3791**	**H322**	**31.5**	**3683**	**H335***	**31.5**	**3496**
	30.5	3344		27.5	3214		27.5	3078
H380*	**38.0C**	**3717**	**760***	**38.0C**	**3682**	Reduced Load **SR 4759**	**10.0**	**1967**
	34.0	3351		34.0	3331		8.0	1560

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

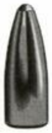


.224" Dia.
45 Grain

Sect. Density .128

	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.420"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**34.0**	**3737**	760*	**38.0C**	**3639**	IMR 4350	**37.0C**	**3535**
	30.0	3284		34.0	3244		33.0	3164
748*	**35.0**	**3666**	H322	**31.0**	**3609**	H335*	**31.0**	**3452**
	31.0	3237		27.0	3163		27.0	3011
IMR 3031	**32.0**	**3650**	H380*	**38.0C**	**3588**	Reduced Load SR 4759	**11.0**	**2039**
	28.0	3176		34.0	3181		9.0	1659



Note: 50 gr. TNT bullet is not recommended at these velocities.

.224" Dia.
50 Grain

Sect. Density .142

	22 Spitz-SP					
Ballistic Coefficient	0.231					
C.O.L. Tested At	2.460"					
Speer Part No.	1029					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**33.5**	**3641**	H414*	**37.0**	**3545**	IMR 3031	**31.5**	**3446**
	29.5	3202		33.0	3159		27.5	3030
748*	**34.5**	**3615**	IMR 4350	**36.5C**	**3526**	H380*	**36.0**	**3440**
	30.5	3224		32.5	3150		32.0	3093
760*	**37.0**	**3557**	H322	**30.5**	**3507**	Reduced Load SR 4759	**11.5**	**2027**
	33.0	3183		26.5	3138		9.5	1679

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. 52 Grain

Sect. Density .147

	22 HP	22 BT HP-Match				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.500"	2.500"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**37.0C**	**3571**	IMR 3031	**31.0**	**3524**	H322	**30.5**	**3445**
	33.0	3170		27.0	3059		26.5	3018
IMR 4064	**33.0**	**3551**	IMR 4350	**36.5C**	**3519**	H414*	**36.0**	**3410**
	29.0	3134		32.5	3122		32.0	3047
748*	**34.0**	**3533**	H380*	**35.5**	**3502**	IMR 4895	**31.0**	**3362**
	30.0	3075		31.5	3096		27.0	2915

.224" Dia. 55 Grain

Sect. Density .157

	22 FMJ BT-Can.	22 Spitz-SP				
Ballistic Coefficient	0.269	0.255				
C.O.L. Tested At	2.500"	2.500"				
Speer Part No.	1044	1047				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**32.5**	**3503**	IMR 4350	**36.0C**	**3397**	IMR 4895	**30.5**	**3251**
	28.5	3095		32.0	3027		26.5	2833
748*	**33.5**	**3424**	760*	**36.0**	**3359**	H414*	**35.0**	**3279**
	29.5	3036		32.0	3003		31.0	2926
H380*	**35.0**	**3414**	H322	**30.0**	**3318**	SR 4759	**12.0**	**2009**
	31.0	3023		26.0	2888		10.0	1679

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. **70 Grain** Sect. Density .199	**22 Semi Spitz-SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.310"					
Speer Part No.	1053					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**36.0**	**3162**	**IMR 4350**	**34.5**	**3064**	**IMR 4064**	**30.0**	**2980**
	32.0	2740		30.5	2743		26.0	2585
IMR 4831	**36.0C**	**3094**	**IMR 4895**	**28.5**	**2988**	**IMR 3031**	**28.0**	**2938**
	32.0	2772		24.5	2543		24.0	2596
H414*	**34.0**	**3092**	**H380***	**32.0**	**2983**	Reduced Load **SR 4759**	**14.0**	**1988**
	30.0	2740		28.0	2590		12.0	1719

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

PRAIRIE DOG
HUNTING AREA
#77

If you're a varmint hunter—signs like this will speed up your pulse in a hurry!

22-250 REMINGTON

This classic, long-range varmint cartridge started life as a wildcat. Although there is some question about who actually invented the cartridge and when it occurred, varmint shooters all agree that the result is no less than spectacular.

In the 1930's a number of experimenters worked to develop a 22 caliber centerfire cartridge based on the efficient 250 Savage case. Although each version was slightly different, the ballistic performance of these early variants were similar. J.E. Gebby trademarked the name "22 Varminter" for his version; other "wildcatters" simply tacked on the name of the parent cartridge and called the cartridge the 22-250.

In 1965, Remington announced that it would introduce the 22-250 as a factory cartridge, although some time earlier Browning offered bolt action rifles chambered for the wildcat version.

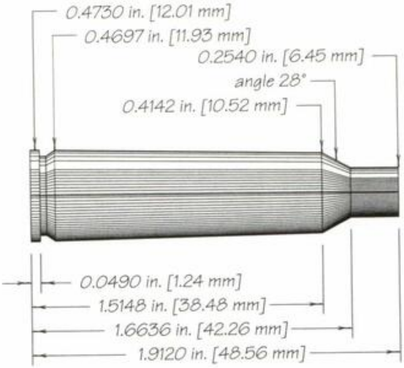
Factory ammunition has a nominal velocity of 3650 feet/sec with a 55 grain bullet, although Federal lists a 40 grain load at nearly 4000 feet/sec! The 22-250 is effective on varmints to ranges beyond 300 yards. Most rifles give exceptional accuracy and the 22-250 is every bit as effective as the famed 220 Swift cartridge in terminal performance. Many reloaders claim the 22-250 offers longer case and barrel life than the Swift and cases and factory ammunition are easier to find.

The 52 grain Speer hollow point is a very popular varmint bullet in the 22-250. The 22-250 is also powerful enough to stabilize Speer's long 70 grain semi-spitzer. We get reports of this combination being used on deer but don't consider this an adequate deer cartridge unless the animals are quite small. The 50 grain Speer TNT™ hollow point is not recommended at 22-250 velocities.

Although factory brass is readily available, some 22-250 shooters still form their own from 308, 30-06 or 250. Reformed cases have less capacity than factory 22-250 cases and loads should be reduced 5 to 10 percent. Custom rifles made before the cartridge was standardized will have dimensional variations in the chambers. Work loads up carefully in these rifles.

These loads do not exceed the industry working pressure of 53,000 cup.

22-250 REMINGTON


0.4730 in. [12.01 mm]
0.4697 in. [11.93 mm]
0.2540 in. [6.45 mm]
angle 28°
0.4142 in. [10.52 mm]
0.0490 in. [1.24 mm]
1.5148 in. [38.48 mm]
1.6636 in. [42.26 mm]
1.9120 in. [48.56 mm]

Max. Case Length: 1.912"
Trim-to Length: 1.902"
Max. Cart. Length: 2.350"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Remington Model 700
Case: R-P
Primers: CCI 200, 250
Comments: TNT bullet not recommended for velocities over 3400 fps.

.224" Dia. **40 Grain** Sect. Density .114	**22 Spire-SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	2.235"					
Speer Part No.	1017					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**38.0**	**4033**	**Re12**	**39.0**	**3912**	**H380***	**43.0C**	**3796**
	34.0	3468		35.0	3403		39.0	3284
Re15	**40.0**	**4027**	**AA 2520***	**37.0**	**3910**	**H414***	**42.0**	**3758**
	36.0	3443		33.0	3382		38.0	3288
H4895	**38.0**	**4025**	**748***	**39.5**	**3867**	**H335***	**37.0**	**3748**
	34.0	3542		35.5	3403		33.0	3280
Viht. N135	**37.0**	**3958**	**760***	**42.0**	**3841**	**IMR 3031**	**36.0**	**3746**
	33.0	3463		38.0	3342		32.0	3315
IMR 4320	**40.0**	**3930**	**IMR 4064**	**38.0**	**3830**	Reduced Load **SR 4759**	**11.0**	**1979**
	36.0	3360		34.0	3390		9.0	1641

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. 45 Grain

Sect. Density .128

	22 Spitz-SP					
Ballistic Coefficient	0.224					
C.O.L. Tested At	2.235"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**37.5**	**3898**	**Re12**	**38.0**	**3712**	**IMR 4895**	**36.0**	**3647**
	33.5	3333		34.0	3211		32.0	3209
Re15	**39.0**	**3897**	**748***	**38.5**	**3708**	**BL-C(2)***	**37.5**	**3633**
	35.0	3351		34.5	3170		33.5	3179
IMR 4320	**39.5**	**3867**	**760***	**41.5C**	**3693**	**IMR 3031**	**35.5**	**3628**
	35.5	3364		37.5	3194		31.5	3211
Viht. N135	**36.5**	**3832**	**IMR 4064**	**37.5**	**3665**	**H335***	**36.5**	**3588**
	32.5	3372		33.5	3207		32.5	3086
H380*	**42.5C**	**3748**	**H414***	**41.5**	**3659**	Reduced Load **SR 4759**	**11.5**	**1984**
	38.5	3317		37.5	3183		9.5	1656

.224" Dia. 50 Grain

Sect. Density .142

	22 Spitz-SP					
Ballistic Coefficient	0.231					
C.O.L. Tested At	2.350"					
Speer Part No.	1029					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**37.0**	**3804**	**760***	**41.0**	**3636**	**748***	**38.0**	**3601**
	33.0	3355		37.0	3218		34.0	3079
Re15	**38.0**	**3736**	**IMR 4064**	**37.0**	**3625**	**IMR 4895**	**35.5**	**3561**
	34.0	3209		33.0	3136		31.5	3116
Viht. N135	**36.0**	**3693**	**Re12**	**37.0**	**3615**	**BL-C(2)***	**37.0**	**3558**
	32.0	3231		33.0	3091		33.0	3149
H380*	**42.0C**	**3693**	**H414***	**41.0**	**3604**	**H335***	**36.0**	**3548**
	38.0	3229		37.0	3081		32.0	3105
AA 2230*	**35.0**	**3685**	**IMR 4320**	**38.0**	**3603**	Reduced Load **SR 4759**	**12.0**	**1982**
	31.0	3188		34.0	3117		10.0	1650

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia.
52 Grain
Sect. Density .147

	22 HP	22 BT HP-Match				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.350"	2.350"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**36.0**	**3715**	**Viht. N140**	**37.5**	**3674**	**Re12**	**36.5**	**3574**
	32.0	3251		33.5	3233		32.5	3092
748*	**38.0**	**3714**	**Re15**	**37.5**	**3662**	**IMR 4064**	**36.5**	**3563**
	34.0	3231		33.5	3204		32.5	3064
H4895	**36.5**	**3713**	**Viht. N135**	**35.5**	**3610**	**IMR 4320**	**37.5**	**3559**
	32.5	3230		31.5	3177		33.5	3150
AA 2460*	**36.5**	**3711**	**760***	**40.5**	**3607**	**IMR 4895**	**35.0**	**3526**
	32.5	3173		36.5	3120		31.0	3121
H380*	**42.0C**	**3700**	**H414***	**40.5**	**3597**	**AA 2520***	**34.0**	**3440**
	38.0	3164		36.5	3093		30.0	3044

.224" Dia.
55 Grain
Sect. Density .157

	22 Spitz-SP					
Ballistic Coefficient	0.255					
C.O.L. Tested At	2.350"					
Speer Part No.	1047					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**36.0**	**3663**	**Viht. N140**	**37.0**	**3582**	**Olin 760***	**39.5**	**3449**
	32.0	3132		33.0	3134		35.5	2949
AA 2460*	**36.0**	**3662**	**H335***	**36.0**	**3532**	**H414***	**40.0**	**3447**
	32.0	3168		32.0	3091		36.0	3016
748*	**38.0**	**3658**	**AA 2520***	**34.0**	**3476**	**IMR 4895**	**35.0**	**3421**
	34.0	3237		30.0	2972		31.0	2993
H380*	**42.0C**	**3633**	**IMR 4064**	**36.0**	**3467**	**IMR 4350**	**40.0C**	**3403**
	38.0	3143		32.0	2999		36.0	3012
H4895	**36.0**	**3630**	**Re12**	**36.0**	**3456**	Reduced Load **SR 4759**	**13.0**	**2002**
	32.0	3104		32.0	3059		11.0	1688

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: Make certain that bullet does not contact rifling.

.224" Dia. **70 Grain** Sect. Density .199	**22 Semi Spitz SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.330"					
Speer Part No.	1053					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**39.0**	**3300**	**IMR 4064**	**33.5**	**3079**	**AA 2460***	**31.0**	**2964**
	35.0	2888		29.5	2725		27.0	2623
IMR 4320	**35.0**	**3158**	**Viht. N140**	**33.0**	**3064**	**Re12**	**31.0**	**2930**
	31.0	2701		29.0	2666		27.0	2578
IMR 4831	**39.0**	**3135**	**IMR 4895**	**32.0**	**3052**	**H335***	**31.0**	**2908**
	35.0	2727		28.0	2671		27.0	2486
IMR 4350	**38.0C**	**3126**	**IMR 3031**	**32.0**	**3018**	**AA 2520***	**30.0**	**2838**
	34.0	2751		28.0	2611		26.0	2441
H380*	**37.0**	**3083**	**Olin 748***	**33.5**	**3011**	Reduced Load **SR 4759**	**15.0**	**1939**
	33.0	2651		29.5	2665		13.0	1711

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

220 SWIFT

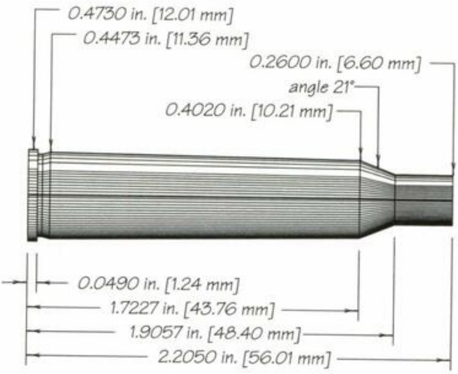
The 220 Swift was the first factory-loaded "ultra-velocity" centerfire rifle cartridge. Introduced by Winchester in 1935, it pushed a 46 grain bullet at speeds over 4000 feet/sec. In the strong Winchester Model 54 rifle (and later the popular Model 70), the Swift was widely acclaimed as the deadliest varmint cartridge.

Unfortunately, the Swift also received a lot of bad press. The speedy, light factory bullet was very sensitive to cross-winds and the operating pressure, higher than most people were accustomed to in 1935, was rough on cases. With the powders then available, throat erosion was a problem and some experts stated that the useful life of a Swift barrel would be less than 1000 rounds. Today, modern propellants combined with heavier bullets fired in the 3600 to 3800 foot/sec range give case and barrel life comparable to any other high-intensity 22 caliber centerfire cartridge.

Poor judgement on the part of some shooters didn't help the Swift either. Some early gun writers, letting enthusiasm get in the way of reason, touted the ability of such high-velocity bullets to produce spectacular kills on deer. Even though the light, varmint-type bullets in factory ammunition couldn't give adequate penetration on big game, some hunters listened to the writers instead of common sense and the Swift accounted for more than its share of wounded deer.

With modern components and reasonable expectations, the Swift is still among the best long-range varmint cartridges. Remington and Ruger have both produced new Swift rifles in recent years. We recommend bullets between 52 and 55 grains for most varmint shooting. For large varmints up to the size of coyotes, the 70 grain Speer semi-spitzer can be used. If you choose the 70 grain bullet, remember to watch seating length so the long bullet doesn't contact the rifling. Speer doesn't consider the Swift to be a deer cartridge, even when handloaded with the 70 grain bullet.

The maximum industry pressure for the Swift is 54,000 cup. These loads do not exceed this level.


0.4730 in. [12.01 mm]
0.4473 in. [11.36 mm]
0.2600 in. [6.60 mm]
angle 21°
0.4020 in. [10.21 mm]
0.0490 in. [1.24 mm]
1.7227 in. [43.76 mm]
1.9057 in. [48.40 mm]
2.2050 in. [56.01 mm]

Max. Case Length: 2.205"
Trim-to Length: 2.195"
Max. Cart. Length: 2.680"
RCBS Shellholder: #11
Barrel Length: 26"
Twist: 1-16"

Test Firearm: Ruger Model 77V
Case: W-W
Primers: CCI 200, 250
Comments: TNT bullet not recommended for this cartridge

.224" Dia. **40 Grain** Sect. Density .114	**22 Spire SP**					
Ballistic Coefficient	0.144					
C.O.L. Tested At	2.650"					
Speer Part No.	1017					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**45.0C**	**4008**	**H450***	**47.0**	**3916**	**AA 4350**	**45.0C**	**3767**
	41.0	3659		43.0	3508		41.0	3322
Re15	**41.0**	**3996**	**760***	**43.0**	**3903**	**Re19**	**46.0C**	**3746**
	37.0	3580		39.0	3497		42.0	3345
Viht. N140	**40.0**	**3943**	**IMR 4350**	**45.0C**	**3883**	**IMR 4064**	**39.0**	**3715**
	36.0	3537		41.0	3424		35.0	3380
Viht. N160	**46.0C**	**3924**	**IMR 3031**	**38.5**	**3878**	Reduced Load **SR 4759**	**12.5**	**1973**
	42.0	3504		34.5	3509		10.5	1662

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. 45 Grain

Sect. Density .128

	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.670"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**40.5**	**4010**	**760***	**42.5**	**3788**	**IMR 3031**	**37.5**	**3723**
	36.5	3537		38.5	2301		33.5	3332
Viht. N160	**46.0C**	**3901**	**AA 4350**	**45.0C**	**3776**	**IMR 4064**	**38.5**	**3653**
	42.0	3484		41.0	3330		34.5	3284
H380*	**44.5C**	**3887**	**H450***	**46.5**	**3758**	**IMR 4350**	**44.5C**	**3476**
	40.5	3548		42.5	3367		40.5	3066
Viht. N140	**39.5**	**3818**	**Re19**	**46.0C**	**3732**	Reduced Load **SR 4759**	**12.5**	**1938**
	35.5	3421		42.0	3338		10.5	1631

.224" Dia. 50 Grain

Sect. Density .142

	22 Spitz SP					
Ballistic Coefficient	0.231					
C.O.L. Tested At	2.650"					
Speer Part No.	1029					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**46.0C**	**3868**	**760***	**42.5**	**3743**	**IMR 3031**	**37.0**	**3607**
	42.0	3453		38.5	3369		33.0	3282
H380*	**44.0**	**3851**	**Viht. N140**	**39.0**	**3739**	**IMR 4831**	**44.0C**	**3599**
	40.0	3515		35.0	3402		40.0	3112
Re15	**40.0**	**3782**	**Re19**	**46.0C**	**3721**	**IMR 4064**	**38.0**	**3564**
	36.0	3388		42.0	3274		34.0	3208
H414*	**42.5**	**3770**	**IMR 4350**	**44.0C**	**3703**	**AA 2700***	**40.0**	**3520**
	38.5	3431		40.0	3265		36.0	3168
AA 4350	**45.0C**	**3760**	**H450***	**46.0**	**3691**	Reduced Load **SR 4759**	**13.0**	**1977**
	41.0	3346		42.0	3306		11.0	1669

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. 52 Grain

Sect. Density .147

	22 HP	22 BT HP-Match				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.680"	2.680"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**46.0C**	**3844**	H380*	**43.5**	**3710**	IMR 3031	**36.5**	**3576**
	42.0	3433		39.5	3387		32.5	3254
Re15	**39.5**	**3742**	IMR 4350	**43.0**	**3688**	H4831	**45.0C**	**3559**
	35.5	3353		39.0	3253		41.0	3135
AA 4350	**45.0C**	**3737**	760*	**41.5**	**3647**	IMR 4064	**37.0**	**3490**
	41.0	3296		37.5	3267		33.0	3166
Re19	**46.0C**	**3715**	H450*	**45.0**	**3614**	H414*	**40.0**	**3425**
	42.0	3324		41.0	3234		36.0	3014
Viht. N140	**39.0**	**3712**	IMR 4831	**44.0C**	**3576**	Reduced Load SR 4759	**13.0**	**2001**
	35.0	3325		40.0C	3075		11.0	1680

.224" Dia. 55 Grain

Sect. Density .157

	22 Spitz SP					
Ballistic Coefficient	0.255					
C.O.L. Tested At	2.650"					
Speer Part No.	1047					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**46.0C**	**3807**	Re15	**39.0**	**3656**	AA 2700*	**41.0**	**3567**
	42.0	3400		35.0	3276		37.0	3257
AA 4350	**45.0C**	**3784**	IMR 4320	**39.0**	**3605**	760*	**40.5**	**3534**
	41.0	3337		35.0	3280		36.5	3166
Re19	**46.0C**	**3710**	H450*	**45.0**	**3598**	IMR 3031	**36.0**	**3506**
	42.0	3227		41.0	3224		32.0	3201
Viht. N140	**39.0**	**3696**	IMR 4350	**43.0**	**3591**	IMR 4831	**43.5**	**3488**
	35.0	3312		39.0	3167		39.5	3017
H380*	**43.0**	**3682**	H4831*	**45.0C**	**3584**	Reduced Load SR 4759	**13.5**	**2000**
	39.0	3362		41.0	3101		11.5	1709

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. **70 Grain** Sect. Density .199	**22 Semi Spitz SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.570"					
Speer Part No.	1053					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**42.0C**	**3364**	**H380***	**38.0**	**3147**	**H414***	**37.0**	**3017**
	38.0	2944		34.0	2873		33.0	2742
AA 3100	**43.0C**	**3269**	**AA 2700***	**38.0**	**3117**	**IMR 4350**	**38.0**	**2992**
	39.0	2886		34.0	2852		34.0	2639
Re15	**36.0**	**3231**	**760***	**37.0**	**3085**	**IMR 4064**	**33.0**	**2939**
	32.0	2895		33.0	2813		29.0	2630
Re19	**42.0C**	**3219**	**H450**	**40.0**	**3058**	Reduced Load **SR 4759**	**14.0**	**1906**
	38.0	2875		36.0	2737		12.0	1642
IMR 4320	**36.0**	**3156**	**IMR 4831**	**40.0**	**3046**			
	32.0	2818		36.0	2635			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

6mm PPC

A companion to the 22 PPC (Pindell-Palmisano Cartridge), the 6mm PPC is also a benchrest cartridge developed from the 220 Russian case. The 6mm has an advantage over the 22 PPC in 200 yard benchrest events, where the heavier 24 caliber bullets are less sensitive to cross-winds.

Although lighter bullets (60 to 70 grains) are used for competition, the 6mm PPC is also a great little varmint cartridge with bullets weights up to 85 grains. Its superb accuracy will surely endear it to varmint shooters and it has sufficient power to take the lighter species of deer when loaded with Speer's 90 grain spitzer.

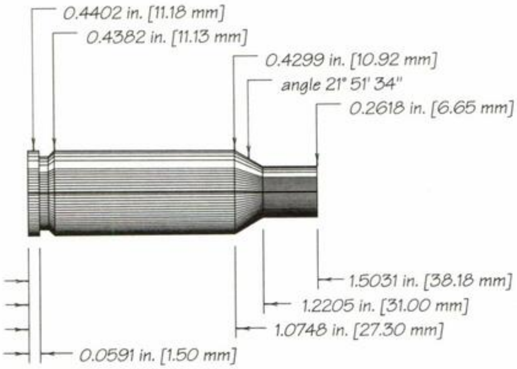
Benchrest rifles have rifling twists of 1-in-14" because light bullets are normally used. The Speer test rifle has 1-in-12" twist which performed well with the heavier bullets. However, bullets weighing more than 90 grains will not be properly stabilized.

Wichita Engineering builds custom sporters and varmint rifles in 6mm PPC caliber. Sako has imported factory rifles in this caliber, along with reloadable cases. In 1993, Ruger announced that it would produce both 22 and 6mm PPC rifles in their No. 1 single-shot and the M77 Mk II Target rifle.

Custom benchrest rifles usually have tight chambers which require that case necks be turned to fit the chamber. Failure to perform this step will raise pressures. If you have a custom rifle, check with the builder to see if neck turning is required. Sporter rifles usually do not require this step in reloading.

Since this is a wildcat cartridge, no industry pressure standards exist. The loads shown were safe in the test rifle.

(l to r), RCBS plant personnel Harriet Shannon, Die Line, Gerald David, Die Line, Everette Acheson, Screw Machine Supervisor, and Ann Rampenthal, Die Line, take time out from production for a photo.


0.4402 in. [11.18 mm]
0.4382 in. [11.13 mm]
0.4299 in. [10.92 mm]
angle 21° 51' 34"
0.2618 in. [6.65 mm]
1.5031 in. [38.18 mm]
1.2205 in. [31.00 mm]
1.0748 in. [27.30 mm]
0.0591 in. [1.50 mm]

Max. Case Length: 1.503"
Trim-to Length: 1.493"
Max. Cart. Length: N/A
RCBS Shellholder: #32
Barrel Length: 22.50"
Twist: 1-12"

Test Firearm: Pindell-Witchita
Case: SAKO
Primers: CCI BR4

.243" Dia. **75 Grain** Sect. Density .181	**6mm HP**					
Ballistic Coefficient	0.234					
C.O.L. Tested At	2.115"					
Speer Part No.	1205					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**30.0C**	**3257**	**Re7**	**25.0**	**3011**	**IMR 4895**	**26.0**	**2705**
	26.0	2790		23.0	2791		24.0	2508
BL-C(2)	**29.0C**	**3169**	**IMR 4198**	**26.0**	**2910**			
	27.0	2931		24.0	2620			
H322	**28.5C**	**3127**	**748**	**29.0C**	**2904**			
	26.5	2910		27.0	2634			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.243" Dia.
80 Grain

Sect. Density .193

	6mm Spitz SP					
Ballistic Coefficient	0.365					
C.O.L. Tested At	2.115"					
Speer Part No.	1211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**30.0C**	**3201**	**Re7**	**24.5**	**2897**	**IMR 4895**	**26.0C**	**2670**
	26.0	2764		22.5	2664		24.0	2468
BL-C(2)	**29.0C**	**3148**	**748**	**29.0C**	**2839**			
	27.0	2929		27.0	2642			
H322	**28.5**	**3095**	**IMR 4198**	**26.0**	**2766**			
	26.5	2887		24.0	2562			

.243" Dia.
85 Grain

Sect. Density .206

	243 Spire SP					
Ballistic Coefficient	0.404					
C.O.L. Tested At	2.115"					
Speer Part No.	1213					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**29.5C**	**3156**	**IMR 4198**	**25.5C**	**3068**	**IMR 4320**	**27.0C**	**2815**
	25.5	2703		23.5	2838		25.0	2623
BL-C(2)	**28.5C**	**3098**	**Re7**	**24.0**	**2863**			
	26.5	2858		22.0	2633			
H322	**28.0C**	**3083**	**748**	**29.0C**	**2838**			
	26.0	2878		27.0	2625			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.243" Dia. **90 Grain** Sect. Density .217	**6mm** **Spitz SP**					
Ballistic Coefficient	0.385					
C.O.L. Tested At	2.115"					
Speer Part No.	1217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**29.0C**	**3031**	**IMR 4198**	**25.0C**	**2916**	**IMR 4895**	**25.5C**	**2603**
	25.0	2601		23.0	2699		23.5	2412
H322	**27.5C**	**2958**	**748**	**28.5C**	**2712**	**IMR 4064**	**25.5C**	**2510**
	25.5	2718		26.5	2505		23.5	2308
BL-C(2)	**28.0C**	**2945**	**IMR 4320**	**26.5C**	**2678**			
	26.0	2714		24.5	2463			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

243 WINCHESTER

Although metric designations sound European, the 6mm (.243-inch), bore was an American development. Winchester introduced a military cartridge, the 6mm Lee Navy, in 1895 and offered a sporting version. However, the smokeless propellants of that era were not well-suited to smaller bores, and the cartridge failed to gain lasting popularity.

Wildcat cartridges using the 6mm bullet begin to show up between 1930 and 1950. Experimenters like Warren Page and RCBS's Fred Huntington built 6mm wildcats using the 308 Winchester and 257 Roberts cases, respectively. These cartridges performed well on both varmints and deer-sized game and pointed the way for commercial development of similar cartridges.

In 1955, Winchester developed the 243 by simply necking down the 308 Winchester case. The case was a natural for light, short-action sporters. The 243 is excellent for varmints and smaller varieties of deer, so many one-gun hunters choose it for its versatility. Factory loads offer an 80 grain bullet for varmints, and a 100 grain bullet for deer; the handloader has a better selection.

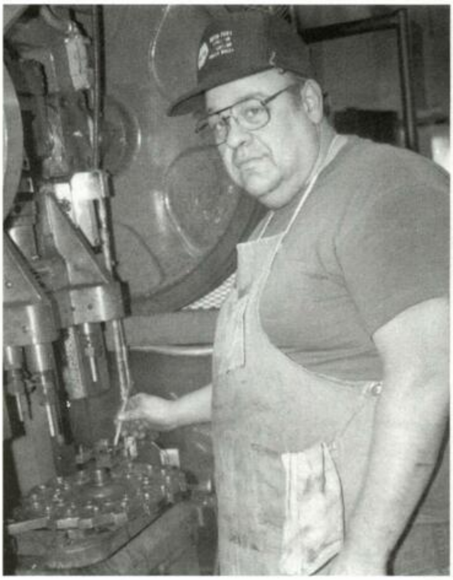
The 243 became very popular and most major rifle makers now offer it as a standard cartridge. Because of its light recoil, the 243 is often picked as the first rifle for new shooters. Although it has adequate power for game animals up to and including deer and antelope, it is definitely under-powered for elk, moose and caribou.

For animals at the upper end of the cartridge's capabilities, the 100 grain Speer Grand Slam offers the bullet integrity for deep penetration. For varmints, the 70 grain TNT and 75 grain hollow point are excellent choices.

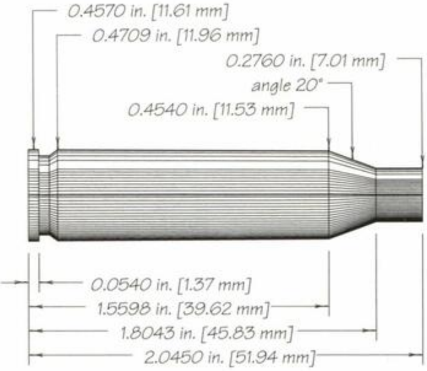
Even though the case is relatively small, slower-burning propellants gave the best velocities. We found that 4350, Reloder 19 and similar propellants performed best with most bullets weights.

Note that the data for the heavier Speer bullets are listed in three groups. In the 243 Winchester, the 100 grain boat tail and the 105 grain round nose produce significantly different pressures from the 100 grain Grand Slam and the 105 grain spitzer. WE EMPHATICALLY RECOMMEND THAT THESE LOADS NOT BE USED WITH BULLETS OF OTHER MAKES AND THAT YOU ALWAYS WORK UP FROM THE STARTING LOADS.

These loads do not exceed the industry maximum pressure of 52,000 cup.



Al Johnson, CCI/Speer employee working on the restrike press.


0.4570 in. [11.61 mm]
0.4709 in. [11.96 mm]
0.2760 in. [7.01 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0540 in. [1.37 mm]
1.5598 in. [39.62 mm]
1.8043 in. [45.83 mm]
2.0450 in. [51.94 mm]

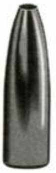
Max. Case Length: 2.045"
Trim-to Length: 2.035"
Max. Cart. Length: 2.710"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-10"

Test Firearm: Ruger Model 77 MKII
Case: W-W
Primers: CCI 200, 250

.243" Dia. **70 Grain** Sect. Density .169	**6mm TNT-HP**					
Ballistic Coefficient	0.282					
C.O.L. Tested At	2.625"					
Speer Part No.	1206					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**48.0C**	**3457**	**H414***	**47.0**	**3398**	**IMR 4064**	**41.0**	**3286**
	44.0	3094		43.0	3054		37.0	2988
Viht. N160	**49.0C**	**3441**	**IMR 4831**	**49.0C**	**3388**	**AA 3100**	**48.0C**	**3225**
	45.0	3136		45.0	3090		44.0	2902
Re19	**50.0C**	**3428**	**H380***	**45.0**	**3383**	**IMR 7828**	**50.0C**	**3216**
	46.0	3103		41.0	3130		46.0	2882
IMR 4350	**47.0C**	**3401**	**760***	**46.0**	**3333**	**AA 2700***	**45.0**	**3119**
	43.0	3067		42.0	3003		41.0	2767

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

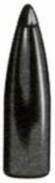


.243" Dia.
75 Grain

Sect. Density .181

	6mm HP					
Ballistic Coefficient	0.234					
C.O.L. Tested At	2.625"					
Speer Part No.	1205					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**46.0**	**3326**	**IMR 4831**	**47.5C**	**3252**	**Viht. N160**	**45.5**	**3190**
	42.0	3011		43.5	3004		41.5	2920
H4350	**46.5C**	**3324**	**AA 2700***	**43.5**	**3249**	**H380***	**43.5**	**3189**
	42.5	3031		39.5	2986		39.5	2984
Re19	**48.0**	**3288**	**AA 3100**	**47.5C**	**3214**	**IMR 4064**	**39.5**	**3189**
	44.0	2988		43.5	2884		35.5	2888
760*	**45.0**	**3284**	**IMR 7828**	**50.0C**	**3198**	**H414***	**44.5**	**3175**
	41.0	2999		46.0	2941		40.5	2909



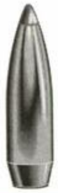
.243" Dia.
80 Grain

Sect. Density .194

	6mm Spitz SP					
Ballistic Coefficient	0.365					
C.O.L. Tested At	2.625"					
Speer Part No.	1211					

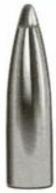
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**50.0C**	**3312**	**H414***	**44.0**	**3188**	**IMR 4320**	**40.0**	**3110**
	46.0	3008		40.0	2905		36.0	2797
H4350	**46.0C**	**3279**	**IMR 4831**	**46.0**	**3165**	**H380***	**41.0**	**3054**
	42.0	2980		42.0	2873		37.0	2738
H4831	**49.0C**	**3260**	**IMR 4064**	**39.0**	**3159**	**AA 2700***	**41.0**	**3032**
	45.0	3017		35.0	2880		37.0	2734
IMR 4350	**45.0**	**3226**	**AA 3100**	**47.0C**	**3147**	**Re19**	**47.0C**	**2952**
	41.0	2929		43.0	2865		43.0	2649
760*	**44.0**	**3199**	**Viht. N160**	**44.0**	**3118**			
	40.0	2920		40.0	2884			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia. 85 Grain Sect. Density .206	6mm BT Spitz-SP					
Ballistic Coefficient	0.404					
C.O.L. Tested At	2.625"					
Speer Part No.	1213					

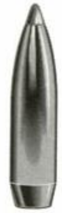
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**46.0C**	**3235**	**AA 3100**	**47.0C**	**3113**	**Viht. N160**	**44.0**	**3053**
	42.0	2914		43.0	2865		40.0	2784
IMR 4831	**46.0**	**3172**	**760***	**43.0**	**3098**	**IMR 4350**	**43.0**	**3017**
	42.0	2837		39.0	2837		39.0	2753
Re19	**47.0**	**3145**	**H414***	**43.0**	**3090**	**IMR 4064**	**38.0**	**3004**
	43.0	2879		39.0	2769		34.0	2709
IMR 7828	**49.0C**	**3136**	**H4831**	**48.0C**	**3074**	Reduced Load **IMR 4198**	**19.0**	**2005**
	45.0	2863		44.0	2845		17.0	1796
AA 2700*	**41.0**	**3136**	**H380***	**42.0**	**3065**			
	37.0	2701		38.0	2779			



.243" Dia. 90 Grain Sect. Density .218	6mm Spitz-SP					
Ballistic Coefficient	0.385					
C.O.L. Tested At	2.625"					
Speer Part No.	1217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**45.0**	**3025**	**760***	**41.0**	**2947**	**IMR 4064**	**36.0**	**2882**
	41.0	2795		37.0	2706		32.0	2628
AA 3100	**45.0**	**2988**	**IMR 4831**	**43.0**	**2927**	**AA 2700***	**39.0**	**2871**
	41.0	2709		39.0	2677		35.0	2543
H4350	**43.0**	**2971**	**H414***	**41.0**	**2922**	**H4831**	**43.0**	**2812**
	39.0	2734		37.0	2628		39.0	2670
IMR 4320	**38.0**	**2969**	**IMR 4350**	**41.0**	**2902**	**IMR 7828***	**47.0C**	**2710**
	34.0	2660		37.0	2647		43.0	2341
Viht. N160	**42.0**	**2959**	**H380***	**39.0**	**2890**	Reduced Load **IMR 4198**	**19.0**	**1990**
	38.0	2671		35.0	2571		17.0	1766

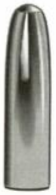
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia.
100 Grain

Sect. Density .242	6mm BT Spitz-SP					
Ballistic Coefficient	0.430					
C.O.L. Tested At	2.635"					
Speer Part No.	1220					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H450*	**42.0**	**2766**	**H380***	**37.0**	**2717**	**IMR 4350***	**38.0**	**2698**
	38.0	2515		33.0	2512		34.0	2469
IMR 4831*	**40.0**	**2743**	**IMR 7828***	**42.0**	**2715**	**AA 2700***	**35.0**	**2524**
	36.0	2513		38.0	2424		31.0	2288
IMR 4320	**35.0**	**2723**	**AA 3100**	**41.0**	**2707**	**760***	**33.0**	**2503**
	31.0	2504		37.0	2458		29.0	2279
Re19	**39.0**	**2718**	**IMR 4064**	**33.0**	**2706**	**H414***	**33.0**	**2450**
	35.0	2493		29.0	2508		29.0	2270



.243" Dia.
105 Grain

Sect. Density .254	6mm RN-SP					
Ballistic Coefficient	0.207					
C.O.L. Tested At	2.585"					
Speer Part No.	1223					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**41.0**	**2771**	**IMR 7828**	**42.0**	**2664**	**Re15**	**33.0**	**2592**
	37.0	2544		38.0	2416		29.0	2382
H4831	**39.0**	**2675**	**H4350**	**38.0**	**2648**	**H380***	**35.0**	**2584**
	35.0	2495		34.0	2398		31.0	2301
IMR 4320	**35.0**	**2670**	**AA 3100**	**40.0**	**2620**	**IMR 4350**	**36.0**	**2567**
	31.0	2450		36.0	2400		32.0	2325

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

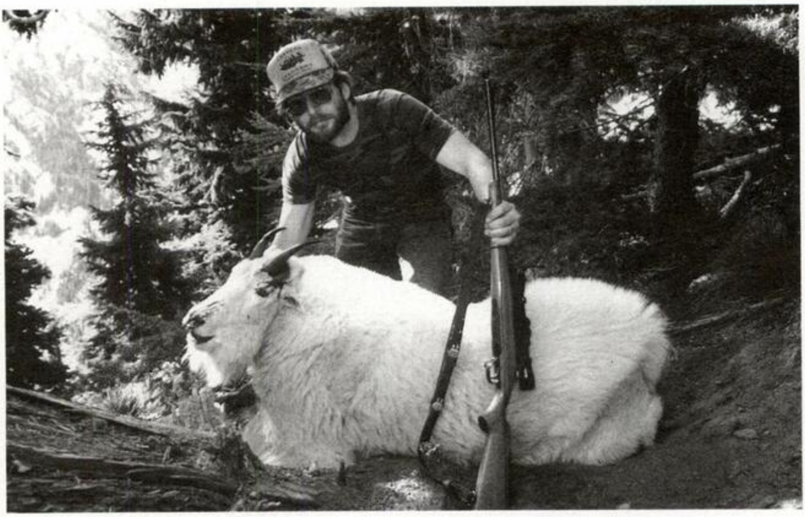
100 Grain Grand Slam®
105 Grain

Note: These loads are not for use with the 100 gr. Boat Tail or the 105 gr. Round Nose.

.243" Dia. **100 Grain** **105 Grain**	**6mm GS-SP**	**6mm Spitz-SP**				
Sectional Density	0.242	0.254				
Ballistic Coefficient	0.351	0.443				
C.O.L. Tested At	2.580"	2.625"				
Speer Part No.	1222	1229				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**42.0C**	**2869**	**Viht. N160**	**40.0**	**2739**	**Re15**	**35.0**	**2675**
	38.0	2576		36.0	2526		31.0	2445
H450*	**44.0**	**2846**	**Re19**	**41.0**	**2731**	**IMR 4350***	**38.0**	**2651**
	40.0	2573		37.0	2578		34.0	2418
AA 3100	**44.0C**	**2839**	**H380***	**38.0**	**2690**	**IMR 4064**	**34.0**	**2650**
	40.0	2579		34.0	2435		30.0	2414
IMR 7828*	**43.0**	**2771**	**IMR 4831**	**40.0**	**2688**	**760***	**37.0**	**2607**
	39.0	2433		36.0	2492		33.0	2359
H4831	**44.0C**	**2762**	**AA 2700***	**39.0**	**2684**	Reduced Load **IMR 4198**	**20.0**	**1965**
	40.0	2555		35.0	2466		18.0	1752

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Local taxidermist, Terry Cravens, took this mountain goat on the North Fork of the Clearwater River in Idaho. (.243 caliber, 105 gr. Spitzer)

6mm REMINGTON & 244 REMINGTON

Remington introduced the 244 Remington in 1955, the same year that Winchester announced the 243. The 244 was very similar to Fred Huntington's wildcat, the 243 Rock Chucker. Both were based on the 257 Roberts case but the commercial version has a 26° shoulder instead of the wildcat's more abrupt 32° shoulder.

Remington intended the new 244 to be a "super" varmint cartridge so their rifles were cut with 1-in-12 inch twist barrels for excellent long-range accuracy with 75 and 80 grain bullets. Factory ammo was loaded with 75 and 90 grain bullets, constructed for varmint shooting. Heavier bullets (up to 105) grains that were available for the 243 Winchester would seldom stabilize in the slow twist rates of most 244 rifles.

On the other hand, the 243 Winchester was conceived as a dual purpose cartridge and rifles featured barrels with a 1-in-10 inch twist. Because it handled the heavy bullets required for deer hunting as well as varmint bullets, the 243 grew in popularity while the 244 slipped.

In 1963, Remington re-introduced the cartridge (and rifles) as the 6mm Remington loaded with 80, 90, and 100 grain bullets. The case remained unchanged, but new rifles were fitted with 1-in-9 inch twist barrels. This simple change made the 6mm Remington the dual-purpose cartridge that the 244 should have been.

Although the 6mm is ballistically similar to the 243, handloaders appreciate its longer neck and the larger case permits loading to somewhat higher velocities, especially with 105 grain bullets. In the lab, we found the 6mm Remington to be much more flexible than the 243 during load development; however, the average handloader using published data will not notice this.

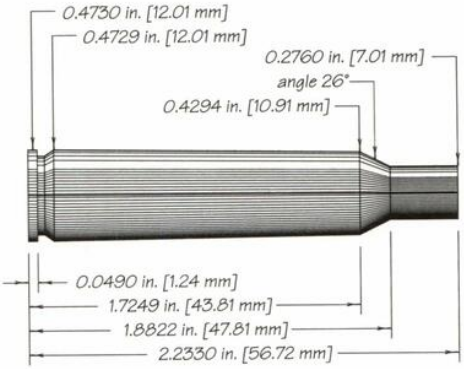
The 6mm's popularity is growing and ammunition and rifles are available from most manufacturers. The 6mm Remington appears here to stay and is an excellent choice for the hunter who wants one rifle for both varmints and deer.

Owners of original 244 Remington rifles can also use this data, but should limit the maximum bullet weight to the Speer 90 grain Hot-Cor spitzer. This is the best bullet for deer in original 244 rifles with 1-in-12 twists. 6mm Remington rifles with their faster rifling twist will handle any Speer .243" bullet quite well.

We have listed the 100 grain boat tail and the 105 grain round nose separately from the 100 grain Grand Slam and 105 grain spitzer. These bullets were grouped by their pressure characteristics. The BT and RN bullets usually produce higher pressures and the charge weights are adjusted accordingly. Do not use these loads with bullets of other makes.

These loads do not exceed the 52,000 cup industry pressure limit for this cartridge.

Jerry Ward, son of CCI/Speer employees Jackie and Jim Ward, with his nice whitetail from Craigmont, Idaho. (6mm, 100 gr. Boat tail)


0.4730 in. [12.01 mm]
0.4729 in. [12.01 mm]
0.2760 in. [7.01 mm]
angle 26°
0.4294 in. [10.91 mm]
0.0490 in. [1.24 mm]
1.7249 in. [43.81 mm]
1.8822 in. [47.81 mm]
2.2330 in. [56.72 mm]

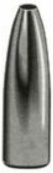
Max. Case Length: 2.233"
Trim-to Length: 2.223"
Max. Cart. Length: 2.825"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-9"

Test Firearm: Remington 700
Case: R-P
Primers: CCI 200, 250

.243" Dia. **70 Grain** Sect. Density .169	**6mm TNT-HP**					
Ballistic Coefficient	0.2.82					
C.O.L. Tested At	2.775"					
Speer Part No.	1206					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 4350	**52.0C**	**3531**	**H380***	**47.0**	**3442**	**IMR 4895**	**42.0**	**33381**
	48.0	3106		43.0	3132		38.0	3111
Re19	**53.0C**	**3507**	**IMR 4064**	**44.0**	**3427**	**H414***	**48.0**	**3370**
	49.0	3262		40.0	3119		44.0	3100
Re22	**54.0C**	**3497**	**760***	**48.0**	**3420**	**Viht. N140**	**43.0**	**3322**
	50.0	3287		44.0	3078		39.0	3023
IMR 4831	**52.0C**	**3485**	**IMR 4350**	**49.0**	**3416**	**H4831***	**52.0C**	**3302**
	48.0	3171		45.0	3040		48.0	3104

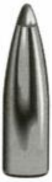
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia.
75 Grain
Sect. Density .181

	6mm HP					
Ballistic Coefficient	0.234					
C.O.L. Tested At	2.775"					
Speer Part No.	1205					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**50.0C**	**3515**	**Re19**	**52.0C**	**3440**	**IMR 4831**	**49.0C**	**3298**
	46.0	3157		48.0	3165		45.0	3001
AA 4350	**51.0C**	**3495**	**IMR 4350**	**48.0C**	**3367**	**Viht. N140**	**43.0**	**3293**
	47.0	3083		44.0	3064		39.0	2999
H450*	**52.5C**	**3488**	**760***	**47.0**	**3318**	**IMR 4064**	**42.5**	**3272**
	48.5	3104		43.0	3018		38.5	3010
Re22	**53.0C**	**3474**	**H4831***	**51.0C**	**3310**	**IMR 4895**	**41.0**	**3248**
	49.0	3262		47.0	3045		37.0	2969
AA 2700*	**47.0**	**3458**	**H380***	**46.0**	**3310**	**H414***	**46.0**	**3216**
	43.0	3147		42.0	3012		42.0	2959

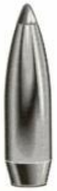


.243" Dia.
80 Grain
Sect. Density .194

	6mm Spitz-SP					
Ballistic Coefficient	0.365					
C.O.L. Tested At	2.775"					
Speer Part No.	1211					

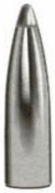
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H450*	**52.0C**	**3414**	**AA 2700***	**46.0**	**3278**	**IMR 4895**	**40.0**	**3139**
	48.0	3038		42.0	2938		36.0	2870
AA 4350	**50.0C**	**3388**	**H4831***	**51.0C**	**3271**	**760***	**46.0**	**3124**
	46.0	2989		47.0	3074		42.0	2874
Re19	**51.0C**	**3368**	**IMR 4350**	**47.0**	**3266**	**IMR 4064**	**41.0**	**3123**
	47.0	3132		43.0	2939		37.0	2873
H4350	**49.0C**	**3355**	**H380***	**45.0**	**3228**	**H414***	**45.0**	**3108**
	45.0	3014		41.0	2931		41.0	2859
Re22	**53.0C**	**3344**	**IMR 4831**	**48.0**	**3192**	Reduced Load **IMR 4198**	**18.0**	**2037**
	49.0	3141		44.0	2968		16.0	1801

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia. **85 Grain** Sect. Density .206	**6mm BT Spitz-SP**					
Ballistic Coefficient	0.404					
C.O.L. Tested At	2.775"					
Speer Part No.	1213					

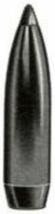
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H450*	**51.0C**	**3336**	**760***	**46.0**	**3152**	**H380***	**43.0**	**3052**
	47.0	2995		42.0	2859		39.0	2777
Re22	**52.0C**	**3285**	**IMR 4350**	**46.0**	**3138**	**IMR 4895**	**39.0**	**3000**
	48.0	3048		42.0	2881		35.0	2742
Re19	**50.5C**	**3269**	**AA 2700***	**44.5**	**3128**	**IMR 4064**	**40.0**	**2965**
	46.5	3007		40.5	2846		36.0	2704
AA 4350	**49.0**	**3264**	**IMR 4831**	**47.0**	**3085**	**Viht. N140**	**39.5**	**2960**
	45.0	2878		43.0	2838		35.5	2723
H4831*	**51.0C**	**3226**	**AA 2520***	**40.0**	**3061**	**H414***	**44.0**	**2921**
	47.0	2968		36.0	2786		40.0	2685



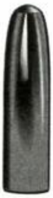
.243" Dia. **90 Grain** Sect. Density .218	**22 Spire-SP**					
Ballistic Coefficient	0.385					
C.O.L. Tested At	2.775"					
Speer Part No.	1217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22	**51.0C**	**3258**	**AA 3100**	**49.0C**	**3154**	**IMR 4064**	**39.0**	**2982**
	47.0	3063		45.0	2870		35.0	2685
Re19	**50.0**	**3256**	**IMR 4350**	**46.0**	**3107**	**AA 2700***	**43.0**	**2974**
	46.0	2976		42.0	2858		39.0	2706
H450*	**50.0**	**3229**	**760***	**45.0**	**3055**	**IMR 4895**	**38.0**	**2967**
	46.0	2943		41.0	2811		34.0	2711
AA 4350	**48.0C**	**3205**	**IMR 4831**	**47.0**	**3026**	**Viht. N140**	**39.0**	**2908**
	44.0	2852		43.0	2755		35.0	2675
H4350	**47.0**	**3170**	**H414***	**44.0**	**2999**	Reduced Load **IMR 4198**	**19.0**	**1977**
	43.0	2821		40.0	2759		17.0	1770

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



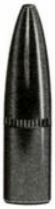
100 Grain



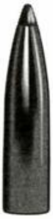
105 Grain

.243" Dia. 100 Grain 105 Grain	6mm BT Spitz-SP	6mm RN-SP				
Sectional Density	0.242	0.256				
Ballistic Coefficient	0.430	0.207				
C.O.L. Tested At	2.775"	2.720"				
Speer Part No.	1220	1223				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**45.0**	**2824**	**AA 4350**	**44.0**	**2764**	**IMR 4350**	**41.0**	**2676**
	41.0	2598		40.0	2460		37.0	2382
H450*	**45.0**	**2822**	**AA 3100**	**45.0**	**2753**	**H380***	**39.0**	**2611**
	41.0	2568		41.0	2478		35.0	2376
Re22	**45.0**	**2774**	**H4350**	**43.0**	**2745**	**AA 2700***	**39.0**	**2602**
	41.0	2608		39.0	2443		35.0	2368



100 Grain Grand Slam®



105 Grain

.243" Dia. 100 Grain 105 Grain	6mm GS-SP	6mm Spitz-SP				
Sectional Density	0.242	0.254				
Ballistic Coefficient	0.351	0.443				
C.O.L. Tested At	2.775"	2.800"				
Speer Part No.	1222	1229				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**45.0**	**3145**	**AA 3100**	**47.0**	**2952**	**AA 2700***	**40.0**	**2710**
	41.0	2831		43.0	2716		36.0	2466
IMR 7828*	**50.0**	**3059**	**H4350**	**44.0**	**2888**	**IMR 4064**	**37.0**	**2694**
	46.0	2814		40.0	2570		33.0	2478
AA 4350	**45.5**	**2979**	**IMR 4350**	**43.0**	**2846**	**H380***	**39.0**	**2616**
	41.5	2622		39.0	2533		35.0	2381
H450*	**47.0**	**2971**	**Re19**	**45.0**	**2835**	**H414***	**40.0**	**2614**
	43.0	2674		41.0	2608		36.0	2353
Re22	**47.0**	**2971**	**760***	**41.0**	**2754**	Reduced Load **IMR 4189**	**20.0**	**1924**
	43.0	2763		37.0	2506		18.0	1725

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

240 WEATHERBY MAGNUM

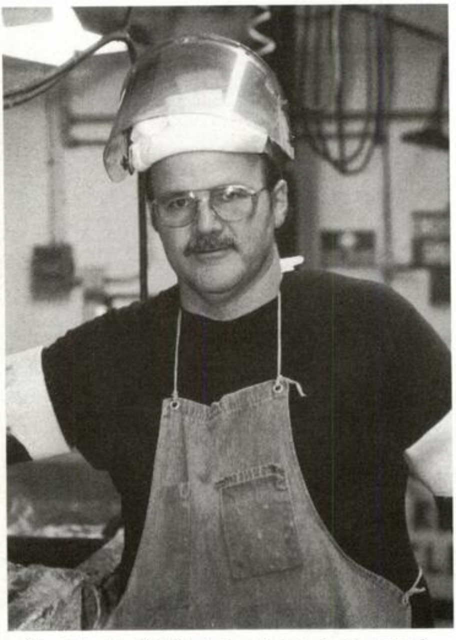
The 240 Weatherby is the only modern 6mm belted magnum. Introduced in 1968 in Weatherby's famous Mark V rifle, it was a totally new case design.

The case has the same rim diameter as the 30-06 so rifles can be built on standard actions. The belt is strictly cosmetic. Best accuracy and case life is obtained when the case headspaces on the shoulder.

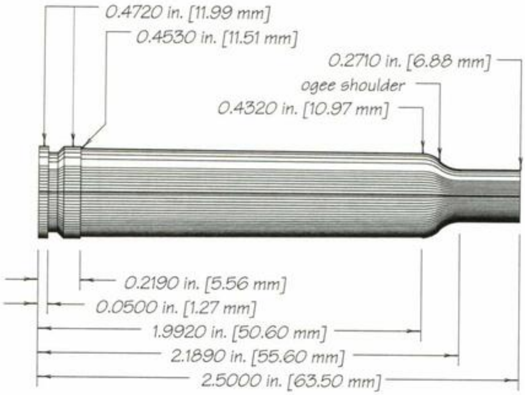
The 240 Weatherby is capable of firing a 100 grain bullet in excess of 3000 feet/sec and the lighter varmint bullets can reach 3600 feet/sec. Although a fine cartridge, the 240 has seen only limited acceptance largely because cases are hard to find, expensive and cannot be formed from any other case.

For the rifleman who has an ample supply of cases, the 240 Weatherby is the premier 6mm cartridge. Its use on game heavier than deer is limited by bullet selection. Most 6mm diameter bullets were designed for lighter game, and often aren't tough enough to handle the Weatherby's velocity potential. One exception is the Speer 100 grain Grand Slam whose thick, tough jacket allows deeper penetration than bullets of weaker construction. Even with the Grand Slam, however, we cannot recommend the 240 as an elk cartridge, although it should be able to handle the larger deer species.

There area no U.S. industry pressure standards for the 240 Weatherby, but Norma indicates a maximum of 55,100 psi. These loads were tested by case head expansion and were safe in our test rifle.

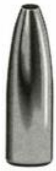


Ken Arends, RCBS plant employee, hard at work in the Black Oxide Department.


0.4720 in. [11.99 mm]
0.4530 in. [11.51 mm]
0.2710 in. [6.88 mm]
ogee shoulder
0.4320 in. [10.97 mm]
0.2190 in. [5.56 mm]
0.0500 in. [1.27 mm]
1.9920 in. [50.60 mm]
2.1890 in. [55.60 mm]
2.5000 in. [63.50 mm]

Max. Case Length: 2.500"
Trim-to Length: 2.490"
Max. Cart. Length: 3.062"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: Weatherby
Primers: CCI 250
Comments: TNT bullet not recommended for this cartridge.



.243" Dia. **75 Grain** Sect. Density .181	**6mm HP**					
Ballistic Coefficient	0.234					
C.O.L. Tested At	3.062"					
Speer Part No.	1205					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**56.0**	**3734**	**760***	**51.5**	**3602**	**IMR 4064***	**46.0**	**3481**
	52.0	3447		47.5	3281		42.0	3126
IMR 4831*	**55.0C**	**3620**	**IMR 4350***	**53.0**	**3583**	**H380***	**49.0**	**3429**
	51.0	3322		49.0	3334		45.0	3094

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

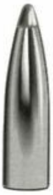
.243" Dia. **80 Grain** Sect. Density .193	**6mm Spitz-SP**					
Ballistic Coefficient	0.365					
C.O.L. Tested At	3.062"					
Speer Part No.	1211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**54.0C**	**3583**	**760***	**51.0**	**3451**	Reduced Load **IMR 4198**	**19.0**	**2022**
	50.0	3327		47.0	3141		17.0	1814
H414*	**53.0**	**3546**	**IMR 4064***	**45.0**	**3408**			
	49.0	3237		41.0	3132			
IMR 4350*	**52.5**	**3509**	**H380***	**48.0**	**3357**			
	48.5	3256		44.0	3029			

.243" Dia. **85 Grain** Sect. Density .206	**6mm BT Spitz-SP**					
Ballistic Coefficient	0.404					
C.O.L. Tested At	3.062"					
Speer Part No.	1213					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**53.0C**	**3473**	**IMR 4350***	**51.5**	**3417**	**IMR 4064***	**44.0**	**3242**
	49.0	3304		47.5	3162		40.0	2976
H414*	**52.0**	**3430**	**760***	**50.0**	**3349**	**H380***	**47.0**	**3236**
	48.0	3161		46.0	3071		43.0	2949

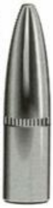
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



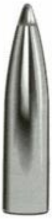
.243" Dia.
90 Grain
Sect. Density .217

	6mm Spitz-SP					
Ballistic Coefficient	0.385					
C.O.L. Tested At	3.062"					
Speer Part No.	1217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**52.0C**	**3420**	760*	**50.0**	**3302**	IMR 4198*	**20.0**	**1982**
	48.0	3176		46.0	2992		18.0	1776
H414*	**52.0**	**3367**	H380*	**47.0**	**3107**			
	48.0	3057		43.0	2813			
IMR 4350*	**50.5**	**3304**	IMR 4064*	**44.0**	**3098**			
	46.5	3059		40.0	2854			



100 Grain Grand Slam®



105 Grain

.243" Dia.
100 Grain
105 Grain

	6mm GS-SP	6mm Spitz-SP				
Sectional Density	0.242	0.254				
Ballistic Coefficient	0.351	0.443				
C.O.L. Tested At	3.062"	3.062"				
Speer Part No.	1222	1229				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**49.0**	**3206**	IMR 4350*	**47.5**	**3007**	Reduced Load IMR 4198*	**22.0**	**2024**
	45.0	2922		43.5	2768		20.0	1831
H414*	**50.0**	**3167**	IMR 4064*	**42.0**	**2977**			
	46.0	2897		38.0	2714			
IMR 4831*	**49.5C**	**3154**	H380*	**45.0**	**2901**			
	45.5	2915		41.0	2601			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

25-20 WINCHESTER (25 W.C.F.)

The 25-20 Winchester was first introduced in the 1890's for the popular Winchester Model 92 lever-action rifle. The action required a short case, so the 25-20 design was based on the older 32-20 WCF case which is about 1.3 inches long.

In the days before the 218 Bee and the 22 Hornet, the 25-20 was popular as a small game and varmint cartridge. Some advertising even suggested using the 25-20 for deer. However, it probably left more game in the field than was ever brought home. It simply is not enough cartridge for deer-sized game.

Until recently, the 25-20 was mostly a fond memory. Marlin brought new life and interest back to the old cartridge by reintroducing it in their excellent Model 1894CL lever action rifle in 1989. Kimber also offered this cartridge for a short time in a bolt-action, single-shot rifle.

Speer introduced a new bullet in 1990 for the Marlin rifle. Input from shooters indicated that 60 grain bullets were too light and the factory 86 grain bullets couldn't be driven fast enough. Therefore, Speer built an 75 grain Hot-Cor bullet which features a crimping cannelure and a flat point so that it can be safely used in tubular magazines. Test bullets fired into ordnance gelatin gave excellent penetration and retaining 99 percent of their original weight (see photo). Our scope-sighted Marlin rifle has fired 100 yard groups measuring just over an inch.

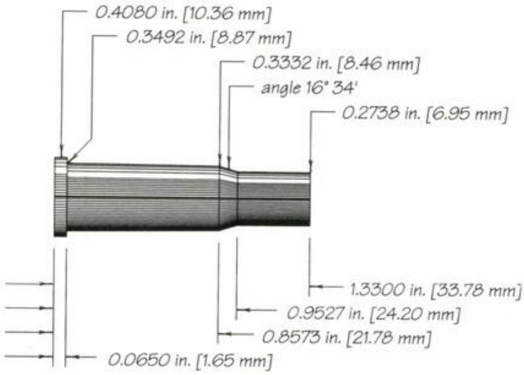
We obtained excellent results from IMR 4198, AA 1680 and AA 2015BR. In fact, these propellants posted much better performance than powders like 2400 and 4227, which are normally thought to be good in such small cases. The walls of the case neck are quite thin so you may find that crimping is better done as a separate operation after bullet seating.

The 25-20 should not be used on animals larger than coyotes. It will never be a deer cartridge, regardless of loading technique or bullet choice. However, it is one of the nicest centerfire turkey cartridges around because its modest velocity destroys less edible meat.

The industry pressure standard for the 25-20 Winchester is 28,000 cup, and these loads do not exceed that limit. DO NOT ATTEMPT TO USE POINTED BULLETS IN RIFLES WITH TUBULAR MAGAZINES. DOING SO CAN CAUSE CARTRIDGES TO EXPLODE IN THE MAGAZINE, DAMAGING THE FIREARM AND POSSIBLY INJURING THE SHOOTER.

Three Speer 25-20 Hot-Cor bullets after being fired into ordnance gelatin at 1800 fps. The retained weight averaged an impressive 99 percent.

25-20 WINCHESTER


0.4080 in. [10.36 mm]
0.3492 in. [8.87 mm]
0.3332 in. [8.46 mm]
angle 16° 34'
0.2738 in. [6.95 mm]
1.3300 in. [33.78 mm]
0.9527 in. [24.20 mm]
0.8573 in. [21.78 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.330"
Trim-to Length: 1.320"
Max. Cart. Length: 1.592"
RCBS Shellholder: #1
Barrel Length: 22"
Twist: 1-14"

Test Firearm: Marlin Model 1894CL
Case: W-W
Primers: CCI 400, 450*

.257" Dia. **75 Grain** Sect. Density .162	**25-20 Flat-SP**					
Ballistic Coefficient	0.133					
C.O.L. Tested At	1.545"					
Speer Part No.	1237					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680*	**12.5**	**2008**	**Viht. N110**	**8.8**	**1838**	**IMR 4227**	**10.0**	**1701**
	11.5	1778		7.8	1658		9.0	1550
IMR 4198	**12.6C**	**1901**	**296***	**8.6**	**1790**	**AA #9***	**7.8**	**1692**
	11.6	1744		7.6	1643		6.8	1492
AA 2015BR	**14.5C**	**1890**	**H110***	**8.4**	**1743**	**2400**	**8.0**	**1685**
	13.5	1768		7.4	1550		7.0	1550

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

250 SAVAGE

The 250 Savage was one of the first high-velocity sporting rifle cartridges introduced to the American market. Designed for Savage by Charles Newton of Newton Rifle Company fame, the cartridge was first offered in the venerable Savage 99 lever action rifle in 1915. Newton wanted to use a 100 grain bullet to make the cartridge suitable for deer-size game, but Savage wanted the new cartridge to deliver 3000 feet/sec at the muzzle for advertising and marketing purposes. Today, this velocity doesn't sound too impressive but, in 1915, no other commercial cartridge had ever reached that speed.

Newton determined that an 87 grain bullet was the heaviest which would achieve 3000 feet/sec at safe pressures. Savage used the name "250-3000" to emphasize the velocity achievement. It made a excellent varmint cartridge, but its penetration was too limited to make it effective on deer. Western Cartridge Company corrected this by introducing a 100 grain load at about 2800 feet/sec in 1921. Soon, the 250 became popular as a dual-purpose cartridge and the name changed to the 250 Savage.

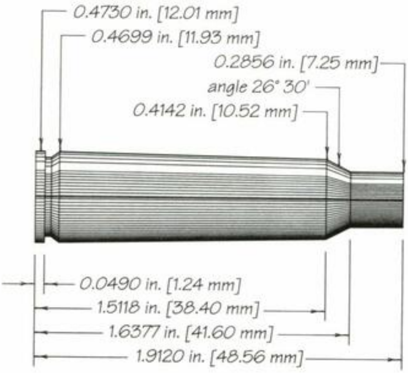
The 250 was also chambered by other firms in bolt-action rifles. Because it has mild recoil, many youngsters started their shooting careers with a 250 Savage rifle.

The introduction of the 243 Winchester and 244 Remington in 1955 caused a decline in the popularity of the 250. In spite of this, the old cartridge has kept its fans. Savage reintroduced the 250 for a time in the Model 99 in 1971, and Ruger, Remington and Weatherby have produced modern bolt-action rifles in this caliber.

With 120 grain bullets, the 250 Savage suffers a significant velocity loss compared to 100 grain bullets. The long bullets seated to industry specification take up a lot of room in the small case. However, velocities between 2400 and 2500 feet/sec are possible with the right propellants. The long bullets at this modest velocity give good penetration and are useful in heavy cover.

Since the 250 will handle bullets up to 120 grains, it is somewhat more flexible than the 6mm cartridges. For larger deer at close range, the 120 grain Speer Grand Slam or the 120 grain Hot-Cor spitzer are the best choices. For small to medium deer, pick the 100 grain Hot-Cor or boat tail spitzers. Varmint hunters will find that the 87 grain TNT hollow point gives spectacular results. The 25 caliber 75 grain flat point bullet, although designed for the 25-20 cartridge, can be used as a short-range plinking or varmint bullet.

The industry maximum pressure for the 250 Savage is established at 45,000 c.u.p. out in deference to lever-action rifles; these loads fall within those limits.


0.4730 in. [12.01 mm]
0.4699 in. [11.93 mm]
0.2856 in. [7.25 mm]
angle 26° 30'
0.4142 in. [10.52 mm]
0.0490 in. [1.24 mm]
1.5118 in. [38.40 mm]
1.6377 in. [41.60 mm]
1.9120 in. [48.56 mm]

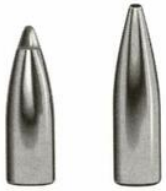
Max. Case Length: 1.912"
Trim-to Length: 1.902"
Max. Cart. Length: 2.515"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Remington 700 Classic
Case: R-P
Primers: CCI 200, 250

.257" Dia. **75 Grain** Sect. Density .162	**25-20** **Flat-SP**					
Ballistic Coefficient	0.133					
C.O.L. Tested At	2.173"					
Speer Part No.	1237					

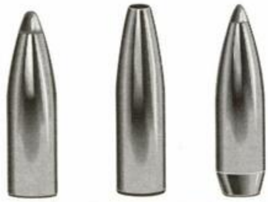
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2520*	**35.5**	**3121**	**760***	**41.0C**	**3020**	**AA 2015BR**	**31.0**	**2860**
	31.5	2821		37.0	2711		27.0	2485
H380*	**42.0C**	**3109**	**H414***	**41.0C**	**2994**	**IMR 4895**	**34.0**	**2853**
	38.0	2832		37.0	2709		30.0	2516
Viht. N133	**32.0**	**3074**	**AA 2460***	**35.0**	**2970**	**H4895**	**33.0**	**2783**
	28.0	2772		31.0	2602		29.0	2437
Re15	**37.0**	**3027**	**IMR 4350**	**41.0C**	**2966**	**IMR 4320**	**33.0**	**2568**
	33.0	2645		37.0	2714		29.0	2262
BL-C(2)*	**37.0**	**3023**	**IMR 4064**	**36.0**	**2929**	Reduced Load **IMR 4198**	**18.0**	**1991**
	33.0	2705		32.0	2580		16.0	1802

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.257" Dia. **87 Grain** Sect. Density .188	**25** **Spitz-SP**	**25** **TNT-HP**				
Ballistic Coefficient	0.300	0.310				
C.O.L. Tested At	2.450"	2.500"				
Speer Part No.	1241	1246				

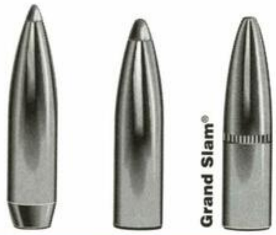
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**42.0C**	**3097**	**Viht. N150**	**36.0**	**2952**	**BL-C(2)***	**35.0**	**2767**
	38.0	2821		32.0	2553		31.0	2476
H414*	**41.0C**	**3005**	**AA 2700***	**41.0**	**2901**	**H4895**	**33.0**	**2749**
	37.0	2749		37.0	2646		29.0	2468
760*	**41.0C**	**2994**	**IMR 4831**	**42.0C**	**2866**	**IMR 4895**	**32.0**	**2664**
	37.0	2733		38.0	2507		28.0	2368
Re15	**37.0**	**2982**	**IMR 4064**	**35.0**	**2849**	**IMR 4320**	**33.0**	**2572**
	33.0	2642		31.0	2578		29.0	2258
IMR 4350	**41.0C**	**2963**	**AA 3100**	**41.0C**	**2788**	Reduced Load **SR 4759**	**14.5**	**1928**
	37.0	2589		37.0	2451		12.5	1622



.257" Dia. **100 Grain** Sect. Density .216	**25** **Spitz-SP**	**25** **HP**	**25 BT** **Spitz-SP**			
Ballistic Coefficient	0.369	0.255	0.393			
C.O.L. Tested At	2.450"	2.400"	2.450"			
Speer Part No.	1405	1407	1408			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2520*	**33.0**	**2763**	**748***	**34.0**	**2649**	**H380***	**35.0**	**2604**
	29.0	2392		30.0	2294		31.0	2256
H414*	**38.0C**	**2743**	**IMR 4350**	**37.5C**	**2647**	**Re15**	**32.0**	**2532**
	34.0	2504		33.5	2313		28.0	2244
760*	**38.0C**	**2716**	**IMR 4831**	**39.0C**	**2633**	**BL-C(2)***	**32.0**	**2509**
	34.0	2480		35.0	2301		28.0	2223
H4350	**38.0C**	**2674**	**IMR 4064**	**33.0**	**2622**	**IMR 4895**	**30.0**	**2462**
	34.0	2340		29.0	2346		26.0	2240
AA 3100	**40.0C**	**2670**	**Viht. N150**	**32.0**	**2607**	**IMR 4320**	**31.0**	**2385**
	36.0	2340		28.0	2255		27.0	2113

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.257" Dia.
120 Grain

Sect. Density .260	25 BT Spitz-SP	25 Spitz-SP	25 GS-SP			
Ballistic Coefficient	0.435	0.410	0.328			
C.O.L. Tested At	2.450"	2.450"	2.515"			
Speer Part No.	1410	1411	1415			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**37.0**	**2511**	**Re15**	**31.0**	**2397**	**IMR 4895**	**28.0**	**2247**
	33.0	2290		27.0	2123		24.0	2067
760*	**36.0**	**2507**	**IMR 4320**	**31.0**	**2371**	**Viht. N150**	**27.0**	**2243**
	32.0	2289		27.0	2084		23.0	2018
Re19	**38.0**	**2497**	**H380***	**33.0**	**2370**	**IMR 4064**	**29.0**	**2236**
	34.0	2200		29.0	2159		25.0	2057
IMR 4831	**37.0**	**2421**	**H4350**	**35.0C**	**2354**	Reduced Load **IMR 4198**	**20.0**	**1858**
	33.0	2116		31.0	2059		18.0	1644
AA 3100	**37.0C**	**2411**	**IMR 4350**	**34.0**	**2344**			
	33.0	2163		30.0	2062			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

257 ROBERTS +P

This fine cartridge started as a wildcat based on the 7mm Mauser case. N. H. (Ned) Roberts necked down the parent case to hold .257" diameter bullets and modified the shoulder angle from 20° to 15°. The cartridge, which he called the 25 Roberts, quickly became popular with custom rifle makers such as Niedner and Griffin & Howe.

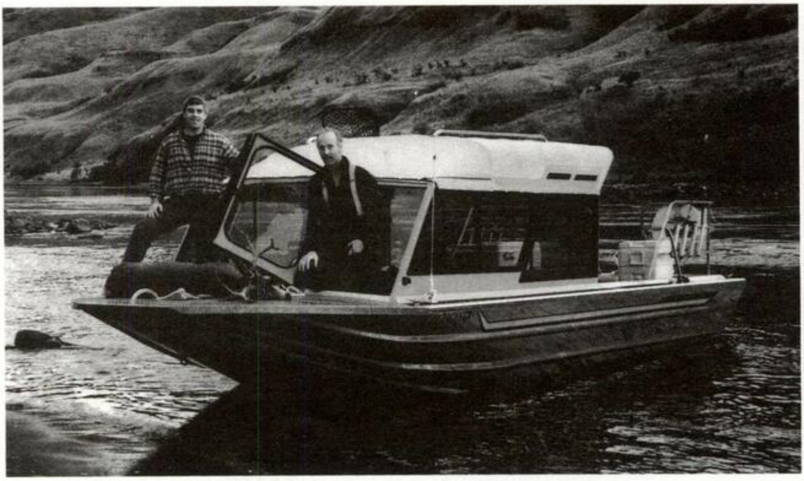
Remington decided to make the wildcat a commercial cartridge, changing only the shoulder to the original 20° angle of the parent cartridge to facilitate production. To avoid confusion with the older 25 Remington cartridge, it was named the 257 Roberts. In 1934, Remington offered their Model 30-S bolt-action in 257. Soon, nearly every rifle maker was producing the 257 Roberts as a standard chambering.

Until the mid-50's, the Roberts was one of the most popular sporting cartridges under 30 caliber. Its ample case gave it a significant performance advantage over the 250 Savage and, with proper bullet selection, the Roberts is suitable on game from varmints to mule deer.

The introduction of the 6mm cartridges in 1955 cut dramatically into the popularity of the 257. As sales dropped, most rifle manufacturers abandoned the 257 in favor of the newer 243 Winchester and the 244 Remington. This is unfortunate because the Roberts' ability to handle 120 grain bullets gave it more flexibility than either of the newcomers.

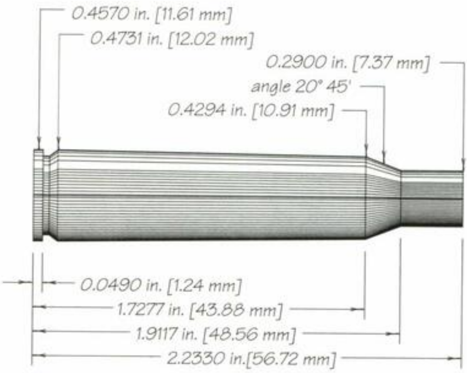
In 1972, Ruger built a short run of its Model 77 bolt-action rifle in 257 Roberts. Later it was added as a standard caliber in several variations of the M77 and the No. 1 single-shot rifle. In the 1980's both Remington and Winchester reintroduced the Roberts in their bolt-actions, evidence that the cartridge's popularity is again on the rise.

Winchester introduced a +P (additional pressure) loading of the 257 using a heavier case. The industry pressure limit for the standard 257 is 45,000 cup; the 257 +P limit is 50,000 cup. THESE LOADS WERE WORKED TO THE HIGHER LIMIT FOR USE IN MODERN BOLT ACTION RIFLES ONLY. If you are loading for an older rifle, a slide action rifle or one built on the Mauser 93/95 action, reduce maximum loads by at least two grains.



Some of the game in Idaho's Hell's Canyon can only be reached by jet boat.

257 ROBERTS +P


0.4570 in. [11.61 mm]
0.4731 in. [12.02 mm]
0.2900 in. [7.37 mm]
angle 20° 45'
0.4294 in. [10.91 mm]
0.0490 in. [1.24 mm]
1.7277 in. [43.88 mm]
1.9117 in. [48.56 mm]
2.2330 in.[56.72 mm]

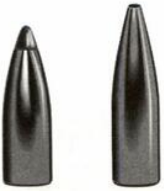
Max. Case Length: 2.233"
Trim-to Length: 2.223"
Max. Cart. Length: 2.780"
RCBS Shellholder: #3/#11
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Ruger Model 77
Case: W-W
Primers: CCI 200, 250

.257" Dia. **75 Grain** Sect. Density .162	**25-20** **Flat-SP**					
Ballistic Coefficient	0.133					
C.O.L. Tested At	2.500"					
Speer Part No.	1237					

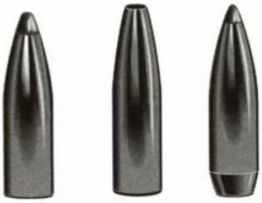
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2700*	**48.0**	**3413**	**Re15**	**43.0**	**3223**	**Viht. N133**	**37.0**	**3092**
	44.0	3078		39.0	2852		33.0	2705
760*	**49.0**	**3375**	**AA 2520***	**40.0**	**3167**	**H335***	**38.0**	**3062**
	45.0	3004		36.0	2862		34.0	2725
AA 4350	**51.0C**	**3319**	**IMR 4895**	**41.0**	**3157**	**H4895**	**39.0**	**3045**
	47.0	2937		37.0	2772		35.0	2673
IMR 4350	**49.0C**	**3265**	**Re12**	**40.0**	**3136**	**BL-C(2)***	**40.0**	**3029**
	45.0	2895		36.0	2776		36.0	2711
AA 3100*	**52.0C**	**3250**	**IMR 4064**	**42.0**	**3126**	**IMR 4320**	**42.0**	**3026**
	48.0	2973		38.0	2795		38.0	2738

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.257" Dia. **87 Grain** Sect. Density .188	**25** **Spitz-SP**	**25** **TNT-HP**				
Ballistic Coefficient	0.300	0.310				
C.O.L. Tested At	2.760"	2.780"				
Speer Part No.	1241	1246				

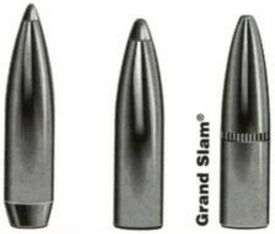
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**51.0C**	**3381**	**760***	**47.0**	**3163**	**748***	**43.0**	**3019**
	47.0	3161		43.0	2868		39.0	2735
IMR 4831	**51.0**	**3226**	**AA 3100**	**52.0C**	**3153**	**H414***	**46.0**	**3009**
	47.0	2993		48.0	2925		42.0	2726
Re19	**51.0C**	**3187**	**Re15**	**43.0**	**3129**	**IMR 4895**	**40.0**	**2977**
	47.0	2947		39.0	2804		36.0	2685
IMR 7828	**54.0**	**3184**	**IMR 4350**	**47.0**	**3059**	**BL-C(2)***	**40.0**	**2924**
	50.0	2955		43.0	2876		36.0	2637
H380*	**46.0**	**3170**	**Viht. N150**	**42.0**	**3029**	Reduced Load **SR 4759**	**17.0**	**2008**
	42.0	2884		38.0	2761		15.0	1762



.257" Dia. **100 Grain** Sect. Density .216	**25** **Spitz-SP**	**25** **HP**	**25 BT** **Spitz-SP**			
Ballistic Coefficient	0.369	0.255	0.393			
C.O.L. Tested At	2.770"	2.760"	2.770"			
Speer Part No.	1405	1407	1408			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**45.0**	**3113**	**IMR 7828**	**51.0C**	**3023**	**Viht. N150**	**38.0**	**2817**
	41.0	2804		47.0	2711		34.0	2521
Re19	**49.0**	**3094**	**IMR 4350**	**45.0**	**2944**	**AA 2700***	**41.0**	**2807**
	45.0	2843		41.0	2694		37.0	2529
H4350	**47.0C**	**3055**	**H414***	**44.0**	**2878**	**Re15**	**37.0**	**2785**
	43.0	2795		40.0	2657		33.0	2509
IMR 4831	**48.0**	**3053**	**IMR 4064**	**39.0**	**2871**	**IMR 4320**	**39.0**	**2768**
	44.0	2805		35.0	2584		35.0	2505
H4831	**50.0C**	**3030**	**H380***	**42.0**	**2842**	Reduced Load **SR 4759**	**17.0**	**1945**
	46.0	2774		38.0	2566		15.0	1728

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.257" Dia. **120 Grain** Sect. Density .260	**25 BT** **Spitz-SP**	**25** **Spitz-SP**	**25** **GS-SP**			
Ballistic Coefficient	0.435	0.410	0.328			
C.O.L. Tested At	2.770"	2.770"	2.780"			
Speer Part No.	1410	1411	1415			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**45.0**	**2793**	**IMR 4064**	**38.0**	**2705**	**IMR 4895**	**34.0**	**2527**
	41.0	2552		34.0	2423		30.0	2249
760*	**43.0**	**2770**	**Re22**	**43.0**	**2635**	**AA 3100**	**42.0**	**2507**
	39.0	2496		39.0	2399		38.0	2301
H414*	**43.0**	**2767**	**IMR 7828**	**44.0**	**2583**	**H380***	**37.0**	**2482**
	39.0	2507		40.0	2304		33.0	2275
IMR 4350	**43.0**	**2758**	**IMR 4320**	**36.0**	**2545**	**AA 2700***	**37.0**	**2440**
	39.0	2512		32.0	2316		33.0	2232
Re19	**43.0**	**2709**	**Re15**	**34.0**	**2541**	Reduced Load **SR 4759**	**19.0**	**2003**
	39.0	2476		30.0	2322		17.0	1776

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

25-06 REMINGTON

The 25-06 is yet another fine wildcat which Remington has made into a successful commercial cartridge. Early references date from around 1920 when the A. O. Niedner Rifle Company offered custom rifles for a cartridge called the 25 Niedner. It was simply the 30-06 necked down to accept .257" bullets. As a custom wildcat, there were minor dimensional variations between the various versions but overall performance was similar.

In its early days, the 25 Niedner and its variations were not viewed as outstanding performers. The large case failed to offer much advantage over the 257 Roberts because very slow-burning powders were not yet available. The introduction of powders such as 4831 caused shooters to look again at the large-case 25 caliber wildcats and the 25-06 began to find a loyal following among custom rifle owners.

In 1969, Remington commercialized the wildcat as the 25-06 Remington and it has since become a standard chambering with many rifle makers. The cartridge is at its best for long-range shooting of animals up to the size of mule deer. With slow burning rate powders such as IMR 7828, H1000, AA 3100 and Reloder 22 available, the 25-06 can now live up to the expectations of its inventors.

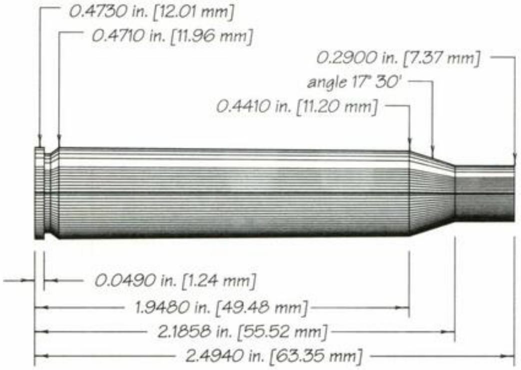
Mark Weber, CCI/Speer, Centerfire Production Supervisor, successfully filled his cow elk tag. (25-06, 100 gr. Spitzer Hot-Cor)

Flat trajectory and high retained energy make the 25-06 an excellent choice for the Western rifleman. The 100 grain boat tail is excellent for shots up to 300 yards on antelope and smaller deer. The 25 caliber Speer Grand Slam is perfect for large deer in the 25-06. The bullet's heavy construction is ideal for the velocities possible with this cartridge.

The 25-06 also sees use as a varmint cartridge, although recoil and propellant usage make it less desirable for this sport than more compact cartridges. The 87 grain TNT hollow point will handle velocities up to 3700 feet/sec making it the best Speer varmint bullet for the 25-06.

If factory 25-06 cases are not available, they can be easily made from 30-06 or 270 Winchester cases. However, be sure to check overall length before loading. The forming process can leave some cases too long, particularly those made from 270 brass.

The industry maximum average pressure for the 25-06 is 53,000 cup. These loads are within those limits.


0.4730 in. [12.01 mm]
0.4710 in. [11.96 mm]
0.2900 in. [7.37 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.1858 in. [55.52 mm]
2.4940 in. [63.35 mm]

Max. Case Length: 2.494"
Trim-to Length: 2.484"
Max. Cart. Length: 3.250"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Remington Model 700 BDL
Case: W-W
Primers: CCI 200, 250

.257" Dia.
87 Grain

Sect. Density .188	25 Spitz-SP	25 TNT-HP				
Ballistic Coefficient	0.300	0.310				
C.O.L. Tested At	3.115"	3.115"				
Speer Part No.	1241	1246				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**60.0C**	**3452**	H414*	**51.0**	**3359**	IMR 4895	**46.0**	**3292**
	56.0	3089		47.0	3077		42.0	3045
H4350	**58.0**	**3431**	AA 3100	**61.0C**	**3357**	H380*	**52.0**	**3268**
	54.0	3157		57.0	3021		48.0	2940
IMR 4831	**59.0**	**3428**	IMR 4064	**49.0**	**3352**	Re15	**47.0**	**3268**
	55.0	3102		45.0	3083		43.0	2983
IMR 7828	**63.0C**	**3419**	H4831	**60.0C**	**3339**	Viht. N140	**48.0**	**3233**
	59.0	3076		56.0	3022		44.0	2959
IMR 4350	**56.0**	**3380**	IMR 4320	**50.0**	**3298**	Reduced Load SR 4759	**17.0**	**1933**
	52.0	3075		46.0	3007		13.0	1502

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.257" Dia. **100 Grain** Sect. Density .216	**25 Spitz-SP**	**25 HP**	**25 BT Spitz-SP**			
Ballistic Coefficient	0.369	0.255	0.393			
C.O.L. Tested At	3.095"	3.095"	3.095"			
Speer Part No.	1405	1407	1408			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**53.0**	**3298**	**H1000**	**61.0C**	**3151**	**H870***	**65.0C**	**3106**
	49.0	3067		57.0	2933		61.0	2887
IMR 4831	**56.0**	**3287**	**H4831**	**56.0**	**3140**	**IMR 4320**	**46.0**	**3101**
	52.0	2997		52.0	2748		42.0	2778
Re22	**58.0**	**3248**	**Viht. N160**	**53.0**	**3129**	**H380***	**47.0**	**2954**
	54.0	2945		49.0	2828		43.0	2680
Re19	**57.0**	**3226**	**AA 3100**	**56.0**	**3120**	**AA 2700***	**46.0**	**2901**
	53.0	2903		52.0	2845		42.0	2616
IMR 7828*	**60.0C**	**3222**	**H414***	**50.0**	**3111**	Reduced Load **SR 4759**	**19.0**	**1892**
	56.0	2892		46.0	2783		15.0	1524

.257" Dia. **120 Grain** Sect. Density .260	**25 BT Spitz-SP**	**25 Spitz-SP**	**25 GS-SP**			
Ballistic Coefficient	0.435	0.410	0.328			
C.O.L. Tested At	3.200"	3.155"	3.090"			
Speer Part No.	1410	1411	1415			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H870*	**64.0**	**3006**	**H1000**	**55.0**	**2922**	**H4350**	**48.0**	**2792**
	60.0	2791		51.0	2644		44.0	2577
IMR 4350	**48.5**	**2990**	**IMR 7828**	**55.0**	**2885**	**H4831**	**47.0**	**2738**
	44.5	2773		51.0	2644		43.0	2521
IMR 4831	**50.0**	**2980**	**AA 4350**	**49.0**	**2843**	**IMR 4320**	**41.0**	**2687**
	46.0	2769		45.0	2655		37.0	2404
Re22	**52.0**	**2931**	**AA 3100**	**51.0**	**2818**	Reduced Load **SR 4759**	**21.0**	**1861**
	48.0	2699		47.0	2567		17.0	1501

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

257 WEATHERBY MAGNUM

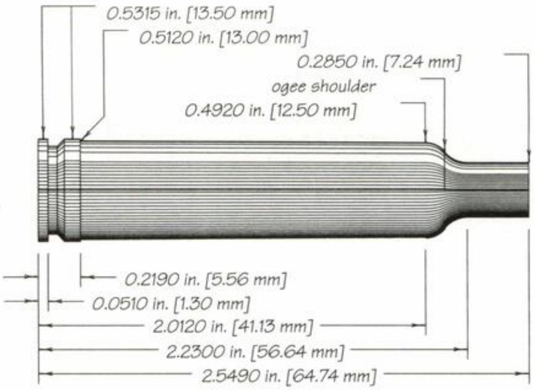
Roy Weatherby built a successful career around the design and production of high-velocity cartridges and the rifles to handle them. The 257 Weatherby Magnum is based on the 300 H&H Magnum belted blown out, case necked down and shortened to operate through standard length actions.

The 257 Weatherby has established an strong reputation as an accurate long-range cartridge for medium game and, with lighter bullets, can be an effective varmint cartridge. It has also been successfully used on African plains animals. Weatherby's case design uses a radiused, or ogee, shoulder instead of the angled one found in most bottleneck cartridges. This design is said to improve the gas flow in the case resulting in a more efficient cartridge.

For large game up to elk, the best bullet is the 120 grain Speer Grand Slam. The velocity potential of the 257 Weatherby requires a tough bullet for big game, and the Grand Slam fills the bill. For long shots on smaller deer, the 100 and 120 grain boat tail bullets can take game beyond 300 yards in the hands of a skilled rifleman. The 87 grain spitzer and the 100 grain hollow point should be used only on varmints in this cartridge. At velocities over 3600 feet/sec, these bullets are too explosive for larger game.

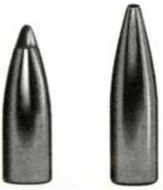
The 257 Weatherby has a 100 to 200 foot/sec advantage over the 25-06, but at the expense of larger powder charges and increased recoil. Like other Weatherby cartridges, the 257 is proprietary and is not covered by industry standards. The loads listed are estimated to produce pressures less than 55,000 psi.

Kristi Youngblood, RCBS employee takes time out from the die line to catch the cameras eye.


0.5315 in. [13.50 mm]
0.5120 in. [13.00 mm]
0.2850 in. [7.24 mm]
ogee shoulder
0.4920 in. [12.50 mm]
0.2190 in. [5.56 mm]
0.0510 in. [1.30 mm]
2.0120 in. [41.13 mm]
2.2300 in. [56.64 mm]
2.5490 in. [64.74 mm]

Max. Case Length: 2.549"
Trim-to Length: 2.539"
Max. Cart. Length: 3.170"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: Weatherby
Primers: CCI 250



.257" Dia. **87 Grain** Sect. Density .188	**25** **Spitz SP**	**25** **TNT-HP**				
Ballistic Coefficient	0.300	0.310				
C.O.L. Tested At	3.150"	3.170"				
Speer Part No.	1241	1246				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**68.0**	**3717**	IMR 4064*	**58.0**	**3621**	AA 8700*	**82.0C**	**3271**
	64.0	3489		54.0	3343		78.0	3112
IMR 4831*	**71.0C**	**3676**	760*	**67.0**	**3595**	Reduced Load SR 4759*	**20.0**	**2030**
	67.0	3459		63.0	3381		16.0	1619
H380*	**65.0**	**3624**	H870*	**82.0C**	**3299**			
	61.0	3394		78.0	3116			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.257" Dia. **100 Grain** Sect. Density .216	**25** **Spitz-SP**	**25** **HP**	**25 BT** **SP**			
Ballistic Coefficient	0.369	0.255	0.393			
C.O.L. Tested At	3.150"	3.140"	3.150"			
Speer Part No.	1405	1407	1408			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**64.0**	**3370**	**H870***	**80.0C**	**3309**	Reduced Load **SR 4759***	**22.0**	**1975**
	60.0	3126		76.0	3106		18.0	1608
H380*	**62.0C**	**3368**	**IMR 4350***	**64.0**	**3254**			
	58.0	3103		60.0	3024			
IMR 4831*	**68.0**	**3361**	**IMR 4064***	**56.0**	**3146**			
	64.0	3125		52.0	2896			

.257" Dia. **120 Grain** Sect. Density .260	**25 BT** **Spitz-SP**	**25** **Spitz-SP**	**25** **GS-SP**			
Ballistic Coefficient	0.435	0.410	0.328			
C.O.L. Tested At	3.170"	3.150"	3.170"			
Speer Part No.	1410	1411	1415			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**65.0**	**3199**	**H414***	**58.0**	**3047**	**IMR 4064***	**52.0**	**2864**
	61.0	2968		54.0	2791		48.0	2613
IMR 4350*	**61.0**	**3079**	**H380***	**59.0**	**3046**	Reduced Load **SR 4759***	**25.0**	**1842**
	57.0	2846		55.0	2801		21.0	1608
H870*	**77.0C**	**3059**	**760***	**59.0**	**2964**			
	73.0	2868		55.0	2782			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

6.5 x 55mm SWEDISH MAUSER

The 6.5x55mm was adopted in 1894 as the service cartridge for both Sweden and Norway. In addition to the Swedish Mauser, the cartridge was also chambered in the Norwegian Krag-Jorgensen rifle. It has been widely used in Europe as a sporting and target cartridge. Accuracy in a quality bolt-action rifle is excellent, and its ability to handle long, 140 grain bullets makes it an excellent game cartridge on species up to and including large deer and black bear. The cartridge uses standard .263" diameter bullets.

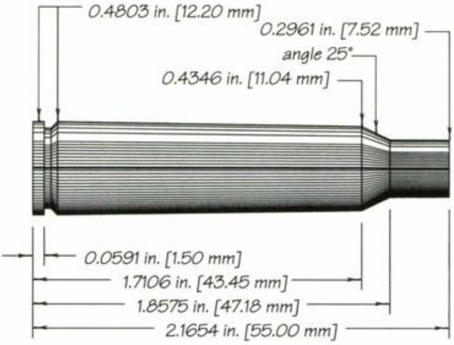
The 6.5x55mm was little known in the United States until the 1950's when large numbers of surplus Swedish rifles and carbines turned up. Ammunition and components were imported by Norma and the caliber became very popular with handloaders. Die sales at RCBS for this cartridge have been in the top 30 for years.

The 120 grain Speer bullet is a good choice for smaller deer species and antelope. For game up to the size of mule deer, the 140 grain spitzer provides the deep penetration that gives the "Swede" its well-earned reputation as a hunting cartridge. In fact, its actual success in the field is better than anyone looking at ballistics tables would imagine. Still, we consider the 6.5mm Swede to be a little light for elk and moose, although plenty of these animals have fallen to the cartridge in the hands of a skilled rifleman.

The industry operating pressure for this cartridge is 45,000 cup. These loads are slightly higher for use in modern rifles. U.S Repeating Arms lists the Winchester Model 70 Featherweight in 6.5 x 55mm. In 1993, Ruger chambered its Model 77 Mk II bolt action for this cartridge, and Remington announced its Model 700 Classic in 6.5x55mm in January of 1994. Swedish Mausers and Krag rifles are not quite as strong as later Mauser designs or modern sporters. REDUCE THE MAXIMUM LOADS BY ONE GRAIN IF YOU ARE LOADING FOR A MILITARY MAUSER OR KRAG. Federal, Remington and Norma produce loaded ammunition, and Norma cases are still available.

We found that the medium- to slow-burning powders worked best, even though the case is relatively small.

6.5 x 55mm SWEDISH MAUSER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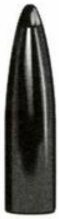
0.2961 in. [7.52 mm]
angle 25°
0.4346 in. [11.04 mm]
0.0591 in. [1.50 mm]
1.7106 in. [43.45 mm]
1.8575 in. [47.18 mm]
2.1654 in. [55.00 mm]

Max. Case Length: 2.165"
Trim-to Length: 2.155"
Max. Cart. Length: 3.150"
RCBS Shellholder: #2
Barrel Length: 22"
Twist: 1-8"

Test Firearm: Ruger Model 77 MkII
Case: Federal
Primers: CCI 200



.263" Dia. **120 Grain** Sect. Density .247	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.433					
C.O.L. Tested At	3.000"					
Speer Part No.	1435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**48.0**	**2895**	IMR 4895	**40.5**	**2860**	IMR 4064	**41.5**	**2826**
	44.0	2655		36.5	2581		37.5	2554
IMR 4831	**49.0**	**2886**	H414	**46.5**	**2856**	IMR 4320	**42.0**	**2779**
	45.0	2650		42.5	2610		38.0	2514
IMR 4350	**47.0**	**2884**	H450	**50.0**	**2845**	AA 2700	**44.5**	**2776**
	43.0	2639		46.0	2617		40.5	2526
Re22	**50.5C**	**2882**	Re19	**49.0**	**2826**	Reduced Load SR 4759	**17.0**	**1911**
	46.5	2654		45.0	2593		15.0	1673

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.263" Dia. **140 Grain** Sect. Density .289	**6.5mm** **Spitz-SP**					
Ballistic Coefficient	0.496					
C.O.L. Tested At	3.035"					
Speer Part No.	1441					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22	**48.0**	**2671**	**IMR 4831**	**46.0**	**2610**	**IMR 4320**	**40.5**	**2567**
	44.0	2449		42.0	2383		36.5	2313
H450	**48.0**	**2639**	**Re19**	**46.0**	**2601**	**IMR 4064**	**39.5**	**2550**
	44.0	2419		42.0	2375		35.5	2292
Viht. N165	**49.0**	**2639**	**AA 3100**	**47.0**	**2591**	**H380**	**42.0**	**2549**
	45.0	2424		43.0	2370		38.0	2306
Viht. N160	**45.5**	**2630**	**IMR 4350**	**44.0**	**2572**	Reduced Load **SR 4759**	**17.0**	**1797**
	41.5	2398		40.0	2338		15.0	1570
H414	**44.0**	**2616**	**AA 2700**	**42.5**	**2568**			
	40.0	2378		38.5	2326			

Notes: Bold print denotes maximum loads. They should be used with caution.

6.5mm REMINGTON MAGNUM

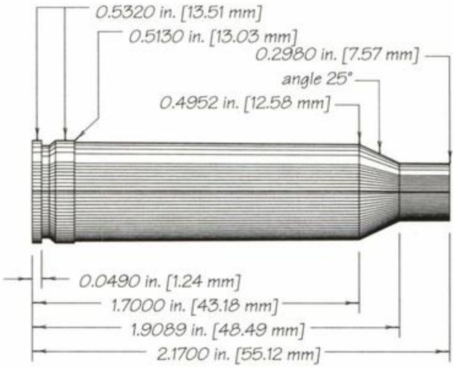
In the mid-1960's, Remington introduced a pair of short Magnum cartridges chambered in the Model 600 and 600 carbines. The 6.5mm and the 350 Remington Magnum were well-suited to the compact actions used in these new rifles. However, the 6.5mm didn't prove very popular. Neither the ammunition or rifles chambered for it were shown in Remington's 1994 catalog.

It seems that 6.5mm (.263" diameter) rifles have not generated much interest in the U.S. The most successful one is the powerful 264 Winchester Magnum, introduced several years before Remington's 6.5mm. The 264 Winchester took a good part of the market interest before Remington's development appeared.

The short-action rifles for which the 6.5 Remington was designed require that the cartridge overall length be held under 2.800 inches. With long bullets like the 140 grain Speer Hot-Cor spitzer, this restricts powder capacity and thus velocity. In a longer action, the bullet could be seated out to allow more powder space. Factory ammo is loaded with 100 and 120 grain bullets; however, the 140 grain Speer bullet gives this cartridge more flexibility. Full-power loads with the 140 grain bullet are adequate for elk and moose at moderate ranges. The Speer test rifle has a 24 inch barrel; expect to see a velocity drop of up to 150 feet/sec when these loads are fired in a carbine.

In spite of some limitations, it would seem that the 6.5 Remington still has a useful life. However, with neither rifles or ammo now available, it appears to be headed for obsolescence. The maximum average pressure for this cartridge is 53,000 cup, and these loads do not exceed that limit.

Ruth Barnes, CCI/Speer Shipping Supervisor, sees to it that the products are when and where they're supposed to go.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.2980 in. [7.57 mm]
angle 25°
0.4952 in. [12.58 mm]
0.0490 in. [1.24 mm]
1.7000 in. [43.18 mm]
1.9089 in. [48.49 mm]
2.1700 in. [55.12 mm]

Max. Case Length: 2.170"
Trim-to Length: 2.160"
Max. Cart. Length: 2.800"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-9"

Test Firearm: Remington Model 700
Case: R-P
Primers: CCI 250

.263" Dia. **120 Grain** Sect. Density .247	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.433					
C.O.L. Tested At	2.790"					
Speer Part No.	1435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 3100*	**57.0C**	**2984**	**IMR 4895***	**47.0**	**2962**	**IMR 4320***	**46.0**	**2875**
	53.0	2787		43.0	2753		42.0	2605
IMR 4831*	**55.0C**	**2970**	**H414***	**50.0**	**2930**	Reduced Load **SR 4759***	**22.0**	**1958**
	51.0	2724		46.0	2665		20.0	1763
IMR 4350*	**53.0C**	**2963**	**H380***	**49.0**	**2900**			
	49.0	2713		45.0	2625			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.263" Dia. **140 Grain** Sect. Density .289	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.496					
C.O.L. Tested At	2.790"					
Speer Part No.	1441					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 3100*	**52.0C**	**2765**	**H380***	**46.0**	**2634**	**IMR 4895***	**45.0**	**2562**
	48.0	2587		42.0	2396		41.0	2321
IMR 4831*	**52.0C**	**2755**	**H414***	**47.0**	**2628**	Reduced Load **SR 4198***	**22.5**	**1792**
	48.0	2547		43.0	2373		20.5	1617
IMR 4350*	**50.0C**	**2750**	**IMR 4320***	**43.0**	**2580**			
	46.0	2543		39.0	2324			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

264 WINCHESTER MAGNUM

The 264 Winchester Magnum is one in a series of four short, belted Magnum cartridges introduced by Winchester beginning in the mid 1950's. The 264 was the smallest of the group and was conceived as a flat-shooting, long-range cartridge. The Winchester model 70 rifle chambered for the new cartridge was named the "Westerner", which was appropriate because the flat trajectory and high retained energy of the 264 was well suited to the demands of western hunting.

The 264 was at its best in the 26 inch barrel of the original Westerner rifle. When shorter barrels were introduced, the muzzle blast was terrific and velocities often fell off to 270 Winchester levels.

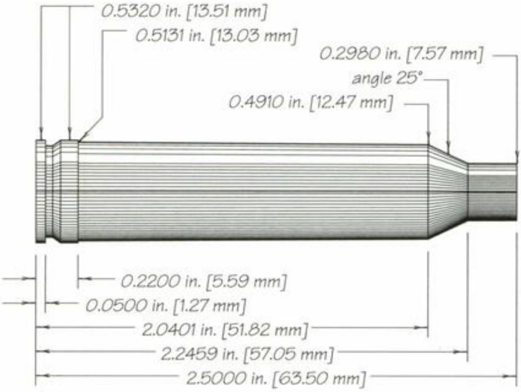
Factory ammunition comes with a 100 grain bullet for varmints and a 140 grain bullet for larger game. Handloaders can choose the Speer 120 grain spitzer for lighter species such as antelope and whitetail deer. The 140 grain spitzer is adequate for all deer and, with careful shot placement, can take elk and moose. The 264 has been used successfully on African plains game, also.

The small bore and the large case capacity of the 264 mean that very slow-burning powders will give best performance. Best accuracy is obtained when cases are sized to headspace on the shoulder (not the belt).

The 264 would likely have been more successful had the 7mm Remington Magnum not appeared in 1962. The 7mm Magnum delivers more energy since it could be loaded with bullets up to 175 grains. Handloaders also had access to a broader selection of bullets for the 7mm, thus increasing its flexibility.

The maximum average pressure for the 264 Magnum is 53,000 cup. These loads do not exceed that limit.

Dora Paul, RCBS Customer Service Representative.


0.5320 in. [13.51 mm]
0.5131 in. [13.03 mm]
0.2980 in. [7.57 mm]
angle 25°
0.4910 in. [12.47 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.0401 in. [51.82 mm]
2.2459 in. [57.05 mm]
2.5000 in. [63.50 mm]

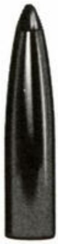
Max. Case Length: 2.500"
Trim-to Length: 2.490"
Max. Cart. Length: 3.340"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-9"

Test Firearm: Remington Model 700
Case: W-W
Primers: CCI 250

.263" Dia. **120 Grain** Sect. Density .247	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.433					
C.O.L. Tested At	3.300"					
Speer Part No.	1435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H870*	**76.0**	**3300**	**H414***	**55.0**	**3069**	**H380***	**53.0**	**2982**
	72.0	3117		51.0	2840		49.0	2718
760*	**59.0**	**3125**	**IMR 4064***	**51.0**	**3053**	Reduced Load **IMR 4198***	**23.0**	**1932**
	55.0	2873		47.0	2789		21.0	1760
IMR 4831*	**59.0**	**3082**	**IMR 4350***	**57.0**	**3021**			
	55.0	2816		53.0	2784			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.263" Dia. **140 Grain** Sect. Density .289	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.496					
C.O.L. Tested At	3.320"					
Speer Part No.	1441					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H870*	**73.0**	**3130**	**IMR 4831***	**56.0**	**2931**	**H380***	**50.0**	**2763**
	69.0	2944		52.0	2683		46.0	2528
760*	**56.0**	**2974**	**IMR 4064***	**49.0**	**2802**	Reduced Load **IMR 4198***	**25.0**	**1890**
	52.0	2703		45.0	2544		23.0	1731
IMR 4350*	**55.0**	**2936**	**H414***	**52.0**	**2785**			
	51.0	2691		48.0	2562			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

270 WINCHESTER

There are a number of really "good" cartridges available, but only a handful can be classed as "great". The 270 Winchester is surely one of the great ones. When the topic of conversation in the hunting camp turns to "the best all-around rifle", the 270 Winchester always gets lots of votes.

Introduced in 1925 in the Winchester Model 54 bolt action rifle, the 270 was one of the first truly effective, long-range rifle cartridges produced. The case was formed by necking the 30-06 case down to hold .277" bullets. The original load, a 130 grain soft point traveling at over 3000 feet/sec, was flat-shooting and very effective on deer-sized game. Later a 100 grain hollow point was introduced. Although the 270 was not conceived as a varmint cartridge, the 100 grain loads were accurate and explosive on varmints out to 300 yards. In response to the demand for a heavier bullet for larger North American game, a 150 grain load soon appeared.

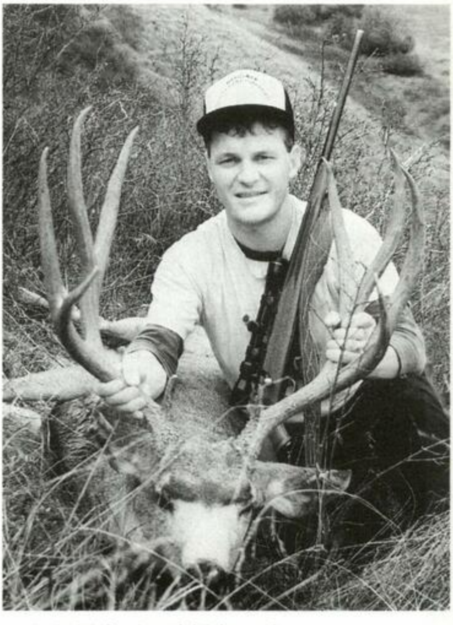
No other person had as much impact on the popularity of the 270 Winchester than outdoorsman and writer Jack O'Conner. He used the 270 for 40 years, taking game with it literally around the world. Jack's written praise of the 270 led many a shooter to choose this cartridge. Almost every make of rifle has been chambered for it.

Loaded with Speer's tough 150 grain Grand Slam bullet, the 270 can readily handle all North American game with the exception of the grizzly and brown bear. The 90 grain TNT hollow point and the 100 grain hollow point give exceptional performance on varmints beyond 300 yards. Most North American hunters with a good 270 in their rack have little reason to shop for a new rifle unless an Alaskan trip is in their plans.

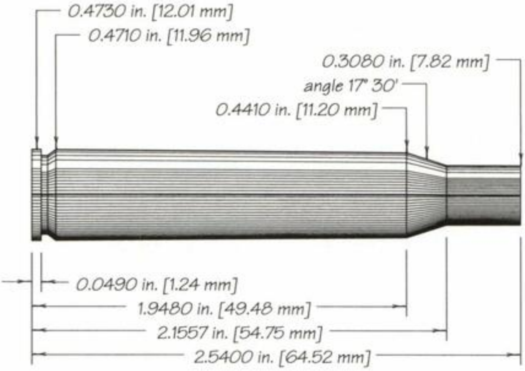
Most factory ammunition and handloads won't quite live up to published factory ballistics when fired in a 22" sporter barrel. The factory specs are measured in a longer pressure/velocity test barrel. Don't try over-loading to meet published factory velocities in the 270. Top velocities are obtained with the slower burning powders.

If the rifleman wants to improve on the long-range performance of the 270, he has to move up to a Magnum case and then the improvement in ballistics is often only marginal.

The listed loads do not exceed the 52,000 cup maximum average pressure established by SAAMI.



Andy McConkey, CCI/Speer Computer Programmer, took this nice muley near Lewiston, Idaho. (.270 caliber, 150 gr. Grand Slam)


0.4730 in. [12.01 mm]
0.4710 in. [11.96 mm]
0.3080 in. [7.82 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.1557 in. [54.75 mm]
2.5400 in. [64.52 mm]

Max. Case Length: 2.540"
Trim-to Length: 2.530"
Max. Cart. Length: 3.340"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-10"

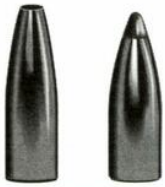
Test Firearm: Ruger Model 77 Mk II
Case: W-W
Primers: CCI 200, 250

Notice: Limit muzzle velocities to 3500 fps.

.277" Dia. **90 Grain** Sect. Density .168	**270 TNT-HP**					
Ballistic Coefficient	0.275					
C.O.L. Tested At	3.170"					
Speer Part No.	1446					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**59.0**	**3450**	**Viht. N140**	**54.0**	**3391**	**IMR 4831***	**62.0C**	**3274**
	55.0	3224		50.0	3095		58.0	3101
IMR 4064	**55.0**	**3433**	**Re19**	**64.0C**	**3341**	**AA 3100***	**62.0C**	**3212**
	51.0	3107		60.0	3044		58.0	2995

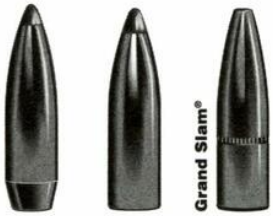
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.277" Dia.
100 Grain
Sect. Density .186

	270 HP	270 Spitz SP				
Ballistic Coefficient	0.225	0.3.19				
C.O.L. Tested At	3.100"	3.145"				
Speer Part No.	1447	1453				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**61.0**	**3356**	**Viht. N140***	**51.0**	**3219**	**AA 3100**	**62.0C**	**3164**
	57.0	3133		47.0	2951		58.0	2937
H414*	**59.0**	**3346**	**IMR 4064**	**52.0**	**3210**	**Re12**	**49.0**	**3038**
	55.0	3153		48.0	2952		45.0	2836
760*	**58.0**	**3290**	**H380***	**55.0**	**3197**	Reduced Load **SR 4759**	**20.0**	**1915**
	54.0	3114		51.0	2956		16.0	1548
Re19	**62.0C**	**3220**	**IMR 4895**	**50.0**	**3169**			
	58.0	2990		46.0	3079			

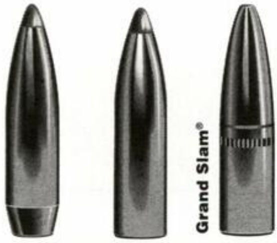


.277" Dia.
130 Grain
Sect. Density .242

	270 BT Spitz-SP	270 Spitz-SP	270 GS-SP			
Ballistic Coefficient	0.449	0.408	0.345			
C.O.L. Tested At	3.240"	3.240"	3.240"			
Speer Part No.	1458	1459	1465			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H1000*	**64.0C**	**3117**	**Re22***	**58.0**	**2947**	**AA 3100***	**56.0**	**2823**
	60.0	2789		54.0	2689		52.0	2549
IMR 7828*	**62.0**	**3066**	**Viht. N160**	**55.5**	**2930**	**IMR 4064**	**47.0**	**2801**
	58.0	2821		51.5	2716		43.0	2627
760*	**54.0**	**3008**	**H414***	**54.0**	**2920**	**Re15**	**45.0**	**2742**
	50.0	2801		50.0	2719		41.0	2548
IMR 4831	**58.0**	**2971**	**IMR 4350**	**55.0**	**2907**	**H380***	**47.0**	**2580**
	54.0	2698		51.0	2873		43.0	2505
H4350	**56.0**	**2949**	**Re19***	**57.0**	**2904**	Reduced Load **SR 4759**	**24.0**	**1998**
	52.0	2733		53.0	2699		20.0	1651

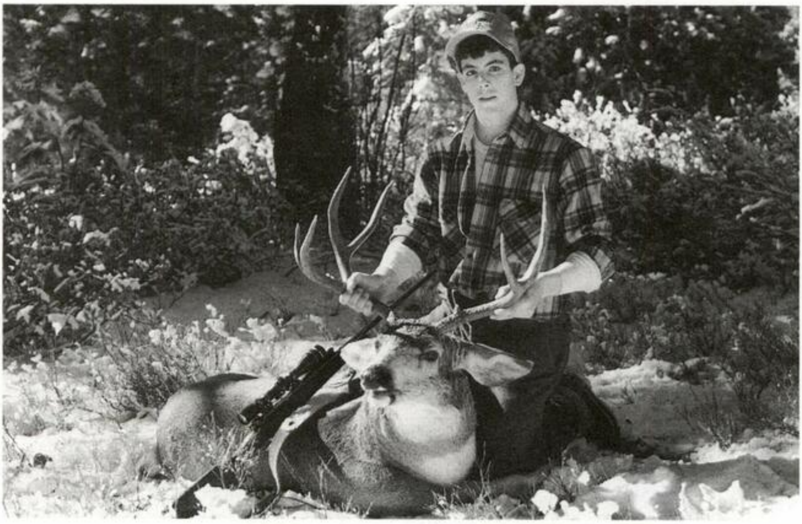
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.277" Dia. **150 Grain** Sect. Density .278	**270 BT Spitz-SP**	**270 Spitz-SP**	**270 GS-SP**			
Ballistic Coefficient	0.496	0.481	0.385			
C.O.L. Tested At	3.270"	3.270"	3.250"			
Speer Part No.	1604	1605	1608			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**58.0C**	**2907**	**Re19***	**53.0**	**2745**	**IMR 4064**	**45.0**	**2635**
	54.0	2694		49.0	2565		41.0	2453
Olin 760*	**53.0**	**2874**	**IMR 4350**	**52.0**	**2727**	**H380**	**45.0**	**2459**
	49.0	2634		48.0	2533		41.0	2326
AA 3100*	**57.0**	**2867**	**H414***	**50.0**	**2680**	**AA 2700***	**44.0**	**2400**
	53.0	2644		46.0	2487		40.0	2206
IMR 4831	**55.0**	**2832**	**Viht. N160**	**51.0**	**2670**	Reduced Load **SR 4759**	**26.0**	**1957**
	51.0	2606		47.0	2465		22.0	1655
Re22	**54.0**	**2769**	**H4350**	**51.0**	**2644**			
	50.0	2562		47.0	2456			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Travis Saleen, son of Tom Saleen, CCI/Speer International Sales Manager, took this real nice muley on the South Fork of the Salmon River in Idaho. (270 caliber, 150 gr. Grand Slam)

270 WEATHERBY MAGNUM

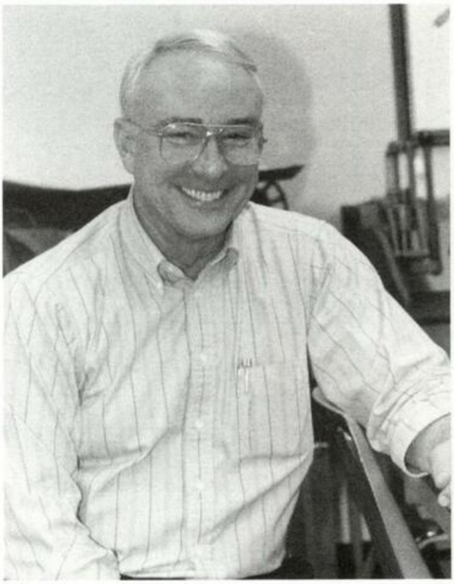
The 270 Weatherby was the first in Roy Weatherby's line of ultra-velocity magnum rifle cartridges, dating back to 1943. Like other Weatherby Magnums, it is based on the belted 300 H&H case blown out and necked down to hold .277" bullets. The cartridge is short enough to function in standard-length actions.

For some reason, the 270 Weatherby has never become quite as popular as the 257 and the 7mm Weatherby Magnums. Perhaps, some of the reason is the remarkable efficiency of the 270 Winchester cartridge. With 150 grain bullets and IMR 4831 powder, the 270 Weatherby needs twenty-one percent more powder to post a six percent increase in velocity over the 270 Winchester. In spite of this, the 270 Weatherby is an excellent cartridge. Newer, slow-burning powders like IMR 7828 can now give the Weatherby a distinct advantage over the 270 Winchester.

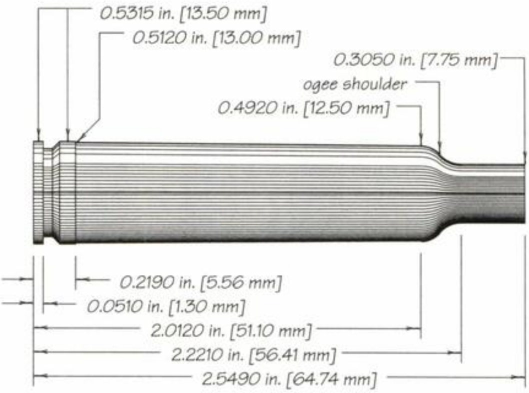
Flat-shooting and accurate, the 270 Weatherby with the right bullet will handle any North American game with the exception of the great bears. Of course, bullets must be matched with the game. The tough construction of the 130 and 150 grain Speer Grand Slams are needed at these velocity levels.

Large capacity, small-bore cartridges have the reputation for being rough on barrel throats. Careful loading and avoiding prolonged, rapid-fire shooting help preserve barrel throats in these high-intensity cartridges.

Since the 270 Weatherby is a proprietary cartridge, no SAAMI pressure standard exists. Norma of Sweden uses a level of 55,100 psi for this cartridge. These loads were safe in the Speer test rifle.



Art Peters, RCBS Product Line Manager, always working toward providing quality products the customer needs.


0.5315 in. [13.50 mm]
0.5120 in. [13.00 mm]
0.3050 in. [7.75 mm]
ogee shoulder
0.4920 in. [12.50 mm]
0.2190 in. [5.56 mm]
0.0510 in. [1.30 mm]
2.0120 in. [51.10 mm]
2.2210 in. [56.41 mm]
2.5490 in. [64.74 mm]

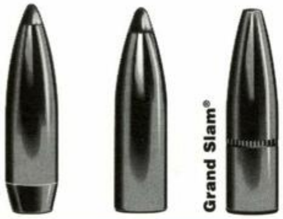
Max. Case Length: 2.550"
Trim-to Length: 2.540"
Max. Cart. Length: 3.295"
RCBS Shellholder: #4
Barrel Length: 26"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: Weatherby
Primers: CCI 250
Comments: 90 gr. TNT not recommended for this cart.

.277" Dia. **100 Grain** Sect. Density .186	**270** **HP**	**270** **Spitz-SP**				
Ballistic Coefficient	0.225	0.319				
C.O.L. Tested At	3.250"	3.250"				
Speer Part No.	1447	1453				

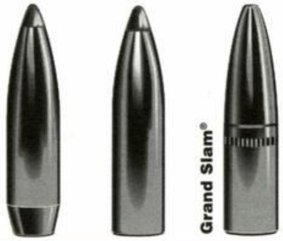
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895*	**64.0**	**3610**	H4831*	**75.0**	**3526**	IMR 7828*	**79.0**	**3395**
	60.0	3390		71.0	3344		75.0	3156
IMR 4350*	**71.0**	**3570**	IMR 4831*	**73.0**	**3505**	Reduced Load SR 4759*	**25.0**	**2035**
	67.0	3387		69.0	3323		21.0	1729
IMR 4320*	**64.0**	**3563**	IMR 4064*	**62.0**	**3399**			
	60.0	3330		58.0	3194			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.277" Dia. 130 Grain Sect. Density .241	270 BT Spitz-SP	270 Spitz-SP	270 GS-SP			
Ballistic Coefficient	0.449	0.408	0.345			
C.O.L. Tested At	3.250"	3.250"	3.210"			
Speer Part No.	1458	1459	1465			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**78.0C**	**3332**	IMR 4350*	**68.0**	**3277**	760*	**65.0**	**2983**
	74.0	3108		64.0	3103		61.0	2766
H4831*	**72.0**	**3304**	IMR 4320*	**62.0**	**3219**	Reduced Load SR 4759*	**28.0**	**2021**
	68.0	3123		58.0	3009		24.0	1739
IMR 4831*	**70.0**	**3281**	IMR 4064*	**59.0**	**3044**			
	66.0	3105		55.0	2847			



.277" Dia. 150 Grain Sect. Density .278	270 BT Spitz-SP	270 Spitz-SP	270 GS-SP			
Ballistic Coefficient	0.496	0.481	0.385			
C.O.L. Tested At	3.250"	3.250"	3.260"			
Speer Part No.	1604	1605	1608			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**76.0C**	**3249**	H4831*	**68.0**	**3016**	760*	**63.0**	**2878**
	72.0	2891		64.0	2851		59.0	2674
IMR 4350*	**66.0**	**3054**	H870*	**82.0C**	**2952**	SR 4759*	**30.0**	**1990**
	62.0	2883		78.0	2793		26.0	1739
IMR 4831*	**67.0**	**3019**	IMR 4320*	**58.0**	**2924**			
	63.0	2852		54.0	2738			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

7-30 WATERS

Well-known experimenter and writer Ken Waters conceived this cartridge as a flat-shooting, lever-action rifle cartridge which could be used in the Model 94 Winchester. Development work began in 1976 and production rifles were finally announced by U.S. Repeating Arms eight years later. Ammunition is made by Federal.

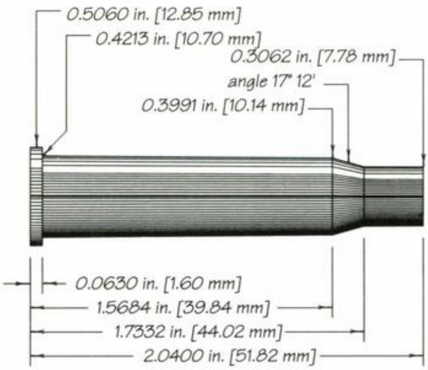
The Waters cartridge uses a 30-30 case necked to hold 7mm (.284") bullets. The new cartridge offers modern ballistic performance in a traditional lever-rifle design. Thompson/Center also chambers the 7-30 Waters in its Contender carbine.

Factory ammunition fires a 120 grain flat-point bullet at 2700 feet/sec. This load has a flatter trajectory than a 30-30, making hits easier between 150 to 225 yards. Its light recoil will appeal to shooters who are recoil-sensitive. For best ballistic performance, the rifle with its 24 inch barrel should be chosen over the carbine version.

Because the cartridge is intended for use in a tubular magazine, factory ammunition is loaded with a flat point bullet. Speer does not manufacture a 7mm bullet of this type for tubular magazines. When using the bullets shown in the data, they must either be singly loaded or loaded with one cartridge in the chamber and only one in the magazine. DO NOT LOAD MORE THAN ONE CARTRIDGE WITH A POINTED BULLET IN A TUBULAR MAGAZINE. TO DO SO WILL EXPOSE THE SHOOTER AND BYSTANDERS TO THE DANGER OF A CARTRIDGE EXPLODING IN THE MAGAZINE. Because the Contender carbine is a single-shot action, any bullet shape may be used.

The 7-30 Waters has proved to be accurate and well-suited to game animals up medium deer. The cartridge has also found a niche with handgun hunters in the Thompson/Center Contender pistol. See the handgun data section for more information on this cartridge.

The industry maximum pressure of the 7-30 is 40,000 c.u.p. These loads do not exceed that limit.


0.5060 in. [12.85 mm]
0.4213 in. [10.70 mm]
0.3062 in. [7.78 mm]
angle 17° 12'
0.3991 in. [10.14 mm]
0.0630 in. [1.60 mm]
1.5684 in. [39.84 mm]
1.7332 in. [44.02 mm]
2.0400 in. [51.82 mm]

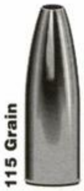
Max. Case Length: 2.040"
Trim-to Length: 2.030"
Max. Cart. Length: 2.550"
RCBS Shellholder: #2
Barrel Length: 24"
Twist: 1-9.5"

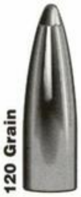
Test Firearm: Winchester 94AE
Case: Federal
Primers: CCI 200, 250*
Comments: Do not use pointed bullets in tubular magazines.

.284" Dia. **110 Grain** Sect. Density .195	**7mm TNT-HP**					
Ballistic Coefficient	0.388					
C.O.L. Tested At	2.550"					
Speer Part No.	1616					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**40.0C**	**2841**	**H4895**	**36.0**	**2739**	**IMR 4895**	**34.5**	**2655**
	36.0	2559		32.0	2425		30.5	2325
748*	**39.0C**	**2834**	**Viht. N135**	**35.0**	**2735**	**AA 2230***	**31.5**	**2642**
	35.0	2503		31.0	2354		27.5	2226
AA 2015BR	**33.0**	**2767**	**H335***	**36.0**	**2716**	**IMR 3031**	**34.0**	**2615**
	29.0	2533		32.0	2498		30.0	2228
Re15	**37.0**	**2757**	**BL-C(2)***	**35.0**	**2665**			
	33.0	2354		31.0	2432			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

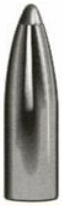




Note: Do not use pointed bullets in tubular magazines.

.284" Dia. **115 Grain** **120 Grain**	**7mm HP**	**7mm Spitz-SP**				
Sectional Density	0.204	0.213				
Ballistic Coefficient	0.257	0.386				
C.O.L. Tested At	2.550"	2.550"				
Speer Part No.	1617	1620				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**37.0**	**2783**	**AA 2015BR**	**32.0**	**2642**	**BL-C(2)***	**34.0**	**2460**
	33.0	2370		28.0	2336		30.0	2158
Re12	**37.0**	**2702**	**Viht. N135**	**34.0**	**2631**	**AA 2230***	**30.0**	**2444**
	33.0	2356		30.0	2316		26.0	2080
H4895	**35.0**	**2690**	**H335***	**34.0**	**2562**	**IMR 4895**	**32.0**	**2435**
	31.0	2363		30.0	2302		28.0	2181
Re15	**36.0**	**2663**	**IMR 3031**	**33.0**	**2552**			
	32.0	2356		29.0	2149			



Note: Do not use pointed bullets in tubular magazines.

.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**					
Ballistic Coefficient	0.394					
C.O.L. Tested At	2.550"					
Speer Part No.	1623					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**35.5**	**2609**	**H4895**	**34.0**	**2514**	**748***	**35.0**	**2487**
	31.5	2253		30.0	2241		31.0	2096
H335*	**33.0**	**2583**	**BL-C(2)***	**36.0**	**2510**	**AA 2015BR**	**30.0**	**2480**
	29.0	2030		32.0	2320		26.0	2206
Viht. N135	**32.5**	**2532**	**IMR 3031**	**33.0**	**2509**	**AA 2230***	**30.0**	**2396**
	28.5	2148		29.0	2320		26.0	2039

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: Do not use pointed bullets in tubular magazines.

.284" Dia. **145 Grain** Sect. Density .257	**7mm Spitz SP**					
Ballistic Coefficient	0.457					
C.O.L. Tested At	2.550"					
Speer Part No.	1629					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**35.0**	**2480**	**BL-C(2)***	**35.0**	**2395**	**IMR 3031**	**31.0**	**2311**
	31.0	2228		31.0	2164		27.0	1979
IMR 4895	**34.0**	**2449**	**AA 2015BR**	**30.0**	**2381**	**AA 2230***	**28.0**	**2201**
	30.0	2130		26.0	2086		24.0	1793
748*	**34.0**	**2435**	**Viht. N135**	**33.0**	**2378**	**Re7**	**25.0**	**2090**
	30.0	2088		29.0	2130		21.0	1802
H4895	**33.0**	**2400**	**H335***	**32.0**	**2360**			
	29.0	2103		28.0	2052			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

7mm-08 REMINGTON

The 7mm-08 evolved from the wildcat 7mm-308 which was a 308 Winchester case necked down. Remington announced the 7mm-08 as a commercial cartridge in 1980 and offered it in the very successful Model 700 rifle and the less expensive Model 788. Factory ammunition was loaded with a 140 grain bullet at 2845 feet/sec, and a 120 grain bullet at 3000 feet/sec (24" test barrel velocities).

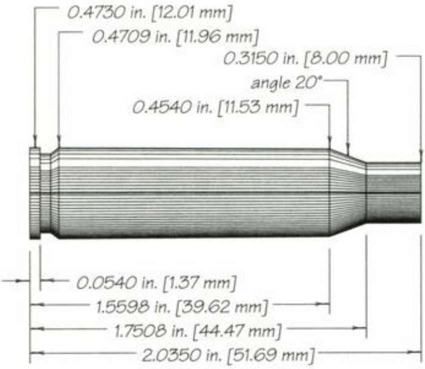
The cartridge was immediately accepted by metallic silhouette shooters who found that the 7mm-08 combined accuracy and power with moderate recoil. It soon became obvious that this cartridge's small size in no way reflected poorly on its performance. Velocities from the 24 inch Model 700V rifle compare favorably with those of the 7mm Remington Magnum in some sporter-length barrels. In addition, we found that the 7mm-08 showed exceptional accuracy with all Speer bullets, from the 110 grain TNT to the 175 grain Mag-Tip and Grand Slam.

With this level of performance, the 7mm-08 is suitable for use on just about any North American game (with the exception of large bear) as long as the proper bullet is used.

Many early rifles in this caliber were intended for target shooting and have 24 inch barrels. In more recent years, the cartridge has found greater acceptance as a hunting cartridge and has been chambered in shorter rifles such as the Remington Model Seven. In the 18.50 inch barrel of the model Seven, expect to see velocities between 80 and 140 feet/sec lower than the ones we show for the Model 700V. Even with this reduction, the 7mm-08 is still a potent hunting cartridge and is very appealing in compact, light-weight rifles.

Some 7mm-08 rifles have short throats. When seating bullets, make sure they do not contact the rifling. Cases can be made easily made from 308 brass by running the cases into a 7mm-08 full-length sizing die. If you are forming from military cases, reduce loads by 10% and work up carefully. Neck thickness of formed cases should be checked before loading and any which are thick must be reamed.Remember to check the case length of any reformed brass before loading.

The industry operating pressure for the 7mm-08 Remington is 52,000 cup. These loads do not exceed that limit.


0.4730 in. [12.01 mm]
0.4709 in. [11.96 mm]
0.3150 in. [8.00 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0540 in. [1.37 mm]
1.5598 in. [39.62 mm]
1.7508 in. [44.47 mm]
2.0350 in. [51.69 mm]

Max. Case Length: 2.035"
Trim-to Length: 2.025"
Max. Cart. Length: 2.800"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-9.25"

Test Firearm: Remington 700V
Case: R-P
Primers: CCI 200, 250

.284" Dia. **110 Grain** Sect. Density .195	**7mm** **TNT-HP**					
Ballistic Coefficient	0.338					
C.O.L. Tested At	2.760"					
Speer Part No.	1616					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**46.0C**	**3250**	**IMR 4064**	**46.0**	**3141**	**Re12**	**45.0**	**2986**
	42.0	3023		42.0	2890		41.0	2792
Re15	**48.0**	**3238**	**Viht. N140**	**46.0**	**3137**	**IMR 4320**	**45.0**	**2973**
	44.0	2930		42.0	2855		41.0	2735
760*	**51.0C**	**3206**	**IMR 4895**	**44.0**	**3066**	**H4895**	**43.0**	**2970**
	47.0	2917		40.0	2851		39.0	2688
H414*	**52.0C**	**3176**	**H4350**	**51.0C**	**3044**	**AA 2460***	**43.0**	**2908**
	48.0	2858		47.0	2779		39.0	2690
H380*	**53.0C**	**3174**	**IMR 4350**	**51.0C**	**3035**	**H335***	**43.0**	**2906**
	49.0	2857		47.0	2777		39.0	2659

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

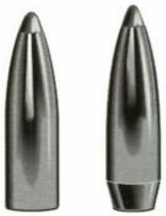
.284" Dia. **115 Grain** Sect. Density .204	**7mm HP**					
Ballistic Coefficient	0.257					
C.O.L. Tested At	2.655"					
Speer Part No.	1617					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**45.0**	**3195**	**IMR 4064**	**45.0**	**3040**	**Re12**	**44.0**	**2954**
	41.0	2971		41.0	2812		40.0	2718
760*	**50.0**	**3116**	**IMR 4350**	**50.0**	**3031**	**AA 2460***	**42.0**	**2942**
	46.0	2851		46.0	2758		38.0	2721
H380*	**52.0C**	**3114**	**Viht. N140**	**45.0**	**3027**	**H4895**	**42.0**	**2942**
	48.0	2818		41.0	2775		38.0	2648
Re15	**46.0**	**3106**	**H4350**	**50.0C**	**2993**	**H335***	**43.0**	**2889**
	42.0	2795		46.0	2709		39.0	2687
H414*	**50.0C**	**3057**	**IMR 4895**	**43.0**	**2955**	**IMR 4320**	**44.0**	**2873**
	46.0	2797		39.0	2719		40.0	2686

.284" Dia. **120 Grain** Sect. Density .213	**7mm Spitz-SP**					
Ballistic Coefficient	0.386					
C.O.L. Tested At	2.700"					
Speer Part No.	1620					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**52.0C**	**3083**	**748***	**45.0**	**3017**	**IMR 4064**	**44.0**	**2981**
	48.0	2871		41.0	2784		40.0	2720
H414*	**51.0C**	**3058**	**IMR 4831**	**52.0C**	**3016**	**IMR 3031**	**42.0**	**2948**
	47.0	2855		48.0	2795		38.0	2701
H380*	**51.0C**	**3047**	**760***	**49.5C**	**3013**	**AA 2460***	**42.0**	**2948**
	47.0	2868		45.5	2807		38.0	2698
Re15	**45.0**	**3037**	**H4350**	**50.0C**	**3010**	**IMR 4895**	**42.0**	**2925**
	41.0	2815		46.0	2838		38.0	2677
Viht. N140	**44.0**	**3029**	**Re12**	**44.0**	**2987**	**H4895**	**41.0**	**2914**
	40.0	2801		40.0	2743		37.0	2681

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**	**7mm BT Spitz-SP**				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	2.730"	2.730"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**45.0**	**3065**	**H380***	**48.0**	**2898**	**H335***	**41.0**	**2788**
	41.0	2835		44.0	2652		37.0	2607
IMR 4350	**50.0**	**3006**	**IMR 3031**	**42.0**	**2886**	**Re15**	**42.0**	**2786**
	46.0	2766		38.0	2684		38.0	2577
H4350	**50.0C**	**2984**	**IMR 4831**	**50.0C**	**2880**	**H4831**	**50.0C**	**2770**
	46.0	2715		46.0	2678		46.0	2493
760*	**49.0**	**2980**	**IMR 4320**	**43.0**	**2821**	**H4895**	**39.0**	**2753**
	45.0	2727		39.0	2595		35.0	2505
H414*	**49.0**	**2954**	**Viht. N140**	**42.0**	**2812**	**AA 2520***	**38.0**	**2662**
	45.0	2673		38.0	2531		34.0	2409

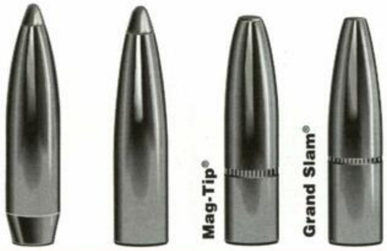
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia.
145 Grain
Sect. Density .257

	7mm BT Spitz-SP	7mm Spitz-SP	7mm BT HP-Match	7mm GS-SP		
Ballistic Coefficient	0.502	0.430	0.465	0.327		
C.O.L. Tested At	2.730"	2.730"	2.800"	2.775"		
Speer Part No.	1628	1629	1631	1632		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**51.0C**	**2933**	**H414***	**47.0**	**2814**	**IMR 4895**	**41.0**	**2724**
	47.0	2692		43.0	2560		37.0	2507
760*	**49.0**	**2920**	**Viht. N165**	**51.0C**	**2781**	**Re15**	**41.0**	**2705**
	45.0	2628		47.0	2553		37.0	2458
H4350	**48.0C**	**2911**	**AA 2520***	**42.0**	**2772**	**H4831**	**49.0C**	**2692**
	44.0	2707		38.0	2519		45.0	2503
AA 4350	**48.0C**	**2843**	**H380***	**46.0**	**2739**	**IMR 4064**	**40.0**	**2681**
	44.0	2644		42.0	2520		36.0	2444
IMR 4350	**48.0**	**2841**	**AA 3100***	**49.0C**	**2725**	**IMR 4831**	**47.0C**	**2680**
	44.0	2644		45.0	2480		43.0	2519

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.284" Dia. **160 Grain** Sect. Density .286	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm MT-SP**	**7mm GS-SP**		
Ballistic Coefficient	0.556	0.502	0.354	0.387		
C.O.L. Tested At	2.800"	2.800"	2.645"	2.760"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**45.0C**	**2735**	**AA 2520***	**40.0**	**2659**	**IMR 4064**	**38.0**	**2513**
	41.0	2475		36.0	2425		34.0	2314
Re19	**47.0C**	**2710**	**Viht. N165**	**49.0C**	**2654**	**Re15**	**38.0**	**2506**
	43.0	2456		45.0	2415		34.0	2343
H414*	**45.0C**	**2704**	**IMR 4831**	**46.0C**	**2615**	**748***	**39.0**	**2503**
	41.0	2474		42.0	2406		35.0	2315
AA 4350	**46.0C**	**2671**	**H4350**	**45.0C**	**2611**	**H380***	**42.0**	**2502**
	42.0	2484		41.0	2423		38.0	2281
IMR 4350	**45.0C**	**2666**	**H4831**	**47.0C**	**2558**	**IMR 4320**	**38.0**	**2444**
	41.0	2463		43.0	2328		34.0	2272

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Mag-Tip®
Grand Slam®

.284" Dia. 175 Grain Sect. Density .310	7mm MT-SP	7mm GS-SP				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	2.745"	2.745"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**47.0C**	**2628**	AA 2520*	**39.0**	**2502**	H380*	**42.0**	**2408**
	43.0	2396		35.0	2314		38.0	2203
Viht. N165	**47.0C**	**2575**	H4831	**45.0C**	**2470**	IMR 4320	**39.0**	**2393**
	43.0	2330		41.0	2243		35.0	2220
IMR 4350	**44.0**	**2542**	IMR 4831	**45.0**	**2465**	IMR 4064	**37.0**	**2353**
	40.0	2365		41.0	2240		33.0	2188
AA 3100	**47.0C**	**2536**	760*	**45.0**	**2461**	Re15	**36.0**	**2312**
	43.0	2336		41.0	2264		32.0	2153
H4350	**44.0C**	**2507**	H414*	**42.0**	**2419**			
	40.0	2326		38.0	2208			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

7mm MAUSER (7 x 57mm)

The 7mm Mauser is one of the oldest sporting cartridges still in active use. Developed for military service around 1892 by Mauser, it was adopted as the Spanish military cartridge in the Model 1893 Mauser rifle. Mexico and several South American countries adopted the 7mm as their service cartridge. In spite of its age, its recent popularity seems to be on the increase.

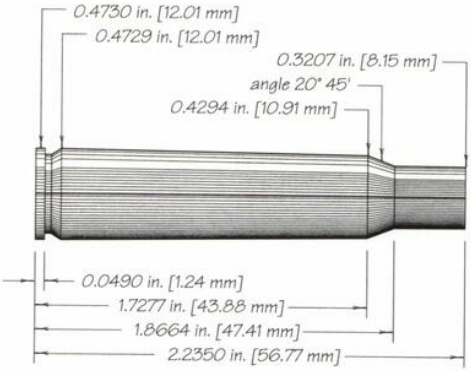
Between the wars, Remington and Winchester chambered rifles for the 7x57 but most were dropped before World War II. American shooters who wanted a 7mm hunting rifle had to buy a foreign model or have an surplus military rifle sporterized. In spite of the poor availability of commercial rifles, the cartridge maintained a reasonable popularity. The American shooting press has always viewed the 7x57mm in a favorable light and thus kept interest in this fine cartridge alive. This was helped by large numbers of quality military surplus Mausers which could be bought for a reasonable price.

Sturm-Ruger built some No. 1 single-shot rifles in this caliber in the early 1970's, and later chambered it in their popular Model 77 bolt-action. Remington and Winchester have also chambered bolt-action rifles in 7x57 in the past decade.

The 7mm Mauser's reputation has been built on a solid record of performance in the hunting fields. It is suitable for game up to large deer and has been used on moose and elk with heavy bullets. Until recently, the only factory ammunition was loaded with a 175 grain soft-point bullet which basically duplicated early military loads. Although a good load, the heavy bullet did not develop the full potential of the cartridge. With a wide choice of component bullets available, it was handloaders who fully realized what the 7mm Mauser could do.

The 7mm has rather mild recoil and is often picked for lightweight sporters or as a first rifle for young shooters. New shooters can start with the 110 grain TNT hollow point or the 115 grain hollow point and move to heavier bullets as their tolerance to recoil increases. The 130 and 145 grain bullets are perfect for smaller deer and antelope, and the 160 and 175 grain bullets provide deep penetration for larger game.

The industry working pressure for the 7mm Mauser is 46,000 cup in deference to the weaker Model 93 and 95 Mausers still in use. THE NEW COMMERCIALS SPORTERS AND ORIGINAL MODEL 98 MAUSERS HAVE STRONGER ACTIONS AND CAN HANDLE SOMEWHAT HEAVIER LOADS. THE FOLLOWING DATA WERE DEVELOPED TO A MAXIMUM PRESSURE OF 50,000 CUP AND SHOULD ONLY BE FIRED IN MODERN COMMERCIAL RIFLES AND MODEL 98 MAUSERS KNOWN TO BE IN GOOD CONDITION. OWNERS OF MODEL 93 AND 95 MAUSERS SHOULD NOT EXCEED THE STARTING LOADS. DO NOT USE THESE LOADS IN ANY REMINGTON ROLLING BLOCK RIFLE. If your rifle is a sporterized military version and you are unsure of the action model, have a gunsmith identify and inspect it before reloading.


0.4730 in. [12.01 mm]
0.4729 in. [12.01 mm]
0.3207 in. [8.15 mm]
angle 20° 45'
0.4294 in. [10.91 mm]
0.0490 in. [1.24 mm]
1.7277 in. [43.88 mm]
1.8664 in. [47.41 mm]
2.2350 in. [56.77 mm]

Max. Case Length: 2.235"
Trim-to Length: 2.225"
Max. Cart. Length: 3.065"
RCBS Shellholder: #3/#11
Barrel Length: 22"
Twist: 1-8.75"

Test Firearm: Ruger M77
Case: R-P
Primers: CCI 200, 250

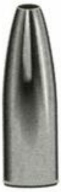
.284" Dia.
110 Grain

Sect. Density .195

	7mm TNT-HP					
Ballistic Coefficient	0.338					
C.O.L. Tested At	2.985"					
Speer Part No.	1616					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**54.0C**	**3250**	IMR 3031	**46.0**	**3084**	IMR 4320	**47.0**	**2941**
	50.0	2941		42.0	2760		43.0	2603
H414*	**54.0C**	**3141**	Viht. N140	**47.0**	**3042**	BL-C(2)*	**45.0**	**2923**
	50.0	2843		43.0	2723		41.0	2601
IMR 4064	**48.0**	**3098**	AA 2700*	**51.0C**	**3023**	H4895	**44.5**	**2907**
	44.0	2757		47.0	2721		40.5	2660
Re15	**48.0**	**3093**	H380*	**50.0C**	**2949**	IMR 4895	**44.0**	**2905**
	44.0	2784		46.0	2654		40.0	2585

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

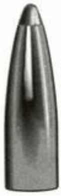


.284" Dia. 115 Grain

Sect. Density .204

	7mm HP					
Ballistic Coefficient	0.257					
C.O.L. Tested At	2.890"					
Speer Part No.	1617					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**53.0C**	**3095**	**Viht. N140**	**46.0**	**2975**	**Re19**	**54.0C**	**2879**
	49.0	2770		42.0	2692		50.0	2591
H414*	**53.0C**	**3053**	**AA 2700***	**51.0C**	**2946**	**H4350**	**51.0C**	**2844**
	49.0	2732		47.0	2651		47.0	2560
IMR 4064	**47.0**	**3041**	**H380***	**50.0C**	**2931**	**IMR 4895**	**43.0**	**2828**
	43.0	2691		46.0	2653		39.0	2593
Re15	**47.0**	**3024**	**IMR 4350**	**51.0C**	**2913**	**BL-C(2)***	**44.0**	**2785**
	43.0	2722		47.0	2630		40.0	2534
IMR 3031	**45.0**	**2996**	**IMR 4320**	**46.0**	**2902**	**H4895**	**43.0**	**2782**
	41.0	2666		42.0	2568		39.0	2546



.284" Dia. 120 Grain

Sect. Density .213

	7mm Spitz-SP					
Ballistic Coefficient	0.386					
C.O.L. Tested At	2.925"					
Speer Part No.	1620					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**54.0C**	**2972**	**IMR 4350**	**50.0**	**2867**	**Re12**	**42.0**	**2765**
	50.0	2690		46.0	2595		38.0	2525
IMR 4320	**46.0**	**2937**	**H414***	**48.0**	**2851**	**IMR 4831**	**50.0C**	**2747**
	42.0	2629		44.0	2594		46.0	2500
H380*	**49.0**	**2886**	**H450***	**53.0C**	**2848**	**748***	**40.0**	**2634**
	45.0	2612		49.0	2563		36.0	2371
AA 4350	**51.0C**	**2873**	**760***	**47.0**	**2778**	**AA 2520***	**38.0**	**2588**
	47.0	2586		43.0	2528		34.0	2316

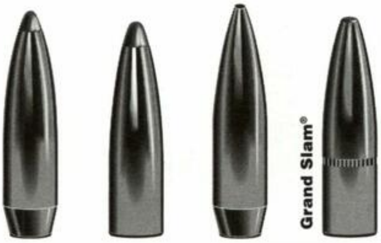
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia. **130 Grain** Sect. Density .230	**7mm** **Spitz-SP**	**7mm BT** **Spitz-SP**				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	2.800"	2.800"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**50.0C**	**2960**	**IMR 4064**	**46.0**	**2871**	**IMR 3031**	**43.0**	**2788**
	46.0	2649		42.0	2555		39.0	2495
760*	**50.0C**	**2952**	**Re22**	**53.0C**	**2860**	**H380***	**47.0**	**2782**
	46.0	2627		49.0	2603		43.0	2476
Re15	**45.0**	**2915**	**IMR 4350**	**50.0C**	**2856**	**IMR 4895**	**42.0**	**2772**
	41.0	2624		46.0	2585		38.0	2481
AA 4350	**51.0C**	**2899**	**Re19**	**52.0C**	**2855**	**Viht. N140**	**42.0**	**2750**
	47.0	2595		48.0	2612		38.0	2489
H4350	**50.0C**	**2890**	**IMR 4320**	**45.0**	**2850**	Reduced Load **SR 4759**	**22.0**	**2004**
	46.0	2630		41.0	2565		18.0	1658

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Elbert Graham, CCI/Speer Southport Manager, and his "best" friend sit by the whitetail deer Elbert shot in the Waha Mountains near Lewiston, Idaho. (7 x 57 caliber, 160 gr. Hot-Cor)

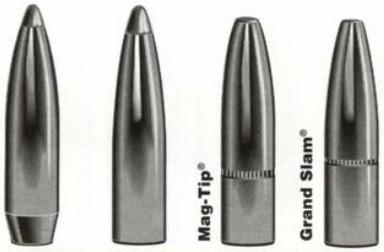


.284" Dia.
145 Grain
Sect. Density .257

	7mm BT Spitz-SP	7mm Spitz-SP	7mm BT HP-Match	7mm GS-SP		
Ballistic Coefficient	0.502	0.457	0.465	0.327		
C.O.L. Tested At	2.800"	2.800"	3.000"	2.970"		
Speer Part No.	1628	1629	1631	1632		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**52.0C**	**2795**	**760***	**48.0C**	**2743**	**IMR 4320**	**43.0**	**2644**
	48.0	2543		44.0	2482		39.0	2380
H4350	**50.0C**	**2784**	**IMR 4350**	**49.0C**	**2727**	**Re15**	**42.0**	**2598**
	46.0	2520		45.0	2469		38.0	2325
AA 4350	**51.0C**	**2757**	**Re22**	**51.0C**	**2684**	**IMR 4895**	**40.0**	**2565**
	47.0	2481		47.0	2442		36.0	2336
H414*	**48.0C**	**2748**	**IMR 4064**	**43.0**	**2679**	**H380***	**44.0**	**2509**
	44.0	2501		39.0	2398		40.0	2246
IMR 4831	**51.0C**	**2745**	**Viht. N160**	**48.0C**	**2665**	Reduced Load **SR 4759**	**22.0**	**1842**
	47.0	2512		44.0	2425		18.0	1517

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.284" Dia.
160 Grain

Sect. Density .284	7mm BT Spitz-SP	7mm Spitz-SP	7mm MT-SP	7mm GS-SP		
Ballistic Coefficient	0.556	0.502	0.354	0.387		
C.O.L. Tested At	3.000"	3.000"	2.960"	2.960"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**46.0**	**2605**	**AA 4350**	**47.0C**	**2520**	**H450***	**47.0C**	**2423**
	42.0	2371		43.0	2255		43.0	2221
H414*	**46.0**	**2582**	**IMR 4350**	**46.0C**	**2515**	**IMR 4320**	**40.0**	**2420**
	42.0	2363		42.0	2262		36.0	2142
IMR 4064	**42.0**	**2573**	**Re22**	**49.0C**	**2514**	**AA 3100**	**47.0C**	**2397**
	38.0	2263		45.0	2237		43.0	2145
Re19	**49.0C**	**2570**	**H4350**	**46.0C**	**2502**	**H380***	**42.0**	**2377**
	45.0	2311		42.0	2252		38.0	2143
IMR 4831	**48.0C**	**2548**	**IMR 4895**	**39.0**	**2467**	**IMR 4198**	**25.0**	**1942**
	44.0	2281		35.0	2196		21.0	1651

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia. **175 Grain** Sect. Density .310	**7mm** **MT-SP**	**7mm** **GS-SP**				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	3.015"	2.995"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22	**51.0C**	**2596**	**IMR 4350**	**45.0**	**2433**	**IMR 4320**	**40.0**	**2378**
	47.0	2362		41.0	2214		36.0	2128
IMR 7828*	**50.0**	**2518**	**H4350**	**45.0**	**2418**	**IMR 4064**	**40.0**	**2378**
	46.0	2266		41.0	2188		36.0	2128
Re19	**48.0**	**2503**	**H414***	**44.0**	**2403**	**AA 4350**	**45.0C**	**2339**
	44.0	2265		40.0	2163		41.0	2138
IMR 4831	**47.0C**	**2443**	**H450***	**47.0C**	**2399**	**Re15**	**38.0**	**2282**
	43.0	2211		43.0	2171		34.0	2042
760*	**44.0**	**2442**	**AA 3100**	**48.0C**	**2399**	**H380***	**41.0**	**2272**
	40.0	2234		44.0	2195		37.0	2068

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

280 REMINGTON (7mm REMINGTON EXPRESS)

[Data may also be used for the 7x64mm and the wildcat 7mm-06 cartridges]

The 280 was introduced by Remington in 1957 in the model 740 semi-automatic rifle. It was nearly identical to the European 7x64mm and the wildcat 7mm/06, which are both excellent cartridges. The 280 Remington gave all the performance of the 270 Winchester with added flexibility because it could handle a wider range of bullet weights.

A short time later, Remington added the 280 to its line of bolt-action rifles and the slide-action Model 760. In spite of the excellent performance of this cartridge, it wasn't an immediate success. Apparently, the 270 had too much head start. Remington ultimately discontinued the 280 in its bolt guns leaving the autoloader model 742 as the only rifle chambered for the 280.

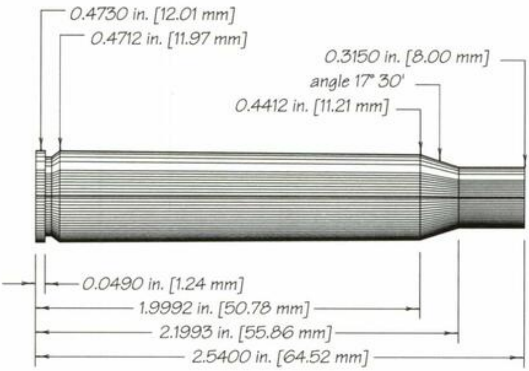
In 1979, Remington reintroduced the 280 in the Model 700 bolt action, renaming it the 7mm Remington Express. Some confusion arose between the new name and the 7mm Remington Magnum so the designation reverted back to the 280 Remington. The 280 is still available in several versions of the Remington Model 700 and the newer Model 7600 slide action rifle, and its popularity is definitely on the rise. Ruger and other makers have also added the 280 in recent years.

The 280 is one of the finest hunting cartridges around, capable of taking any North American game with the exception of the largest bears. For the handloader, it comes closer to qualifying as the "all-around rifle" than the 270 Winchester because of the excellent selection of .284" bullets. The popularity of the 7mm Remington Magnum has surely taken away interest from the 280 because shooters traditionally have been attracted to the "Magnum" concept. However, the performance of the 280 isn't all that far from the 7mm Magnum and it uses significantly less powder.

To prevent 280 ammunition from being accidently chambered in 270 Winchester rifles, the case shoulder is positioned about .050" forward. This is the major difference between the 280 and the wildcat 7mm/06 or the 7x64mm cartridges.

With Speer's 110 grain TNT or 115 grain hollow points, the 280 is an excellent, long-range varmint cartridge. The three weights of Grand Slam bullets allow the 280 to take almost any species of thin-skinned game. When loading for semi-automatic and slide-action rifles, use the lightest load shown. These actions lack the camming power of a manually-operated bolt action, and can experience extraction problems with maximum loads which function fine in bolt-action rifles.

The SAAMI maximum average pressure for the 280 Remington is 50,000 cup. These loads do not exceed that limit.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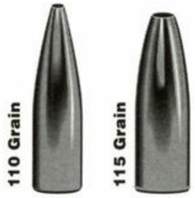
0.4712 in. [11.97 mm]
0.3150 in. [8.00 mm]
angle 17° 30'
0.4412 in. [11.21 mm]
0.0490 in. [1.24 mm]
1.9992 in. [50.78 mm]
2.1993 in. [55.86 mm]
2.5400 in. [64.52 mm]

Max. Case Length: 2.540"
Trim-to Length: 2.530"
Max. Cart. Length: 3.330"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-9.5"

Test Firearm: Ruger M77 Mark II
Case: R-P
Primers: CCI 200, 250


110 Grain
115 Grain

.284" Dia. 110 Grain 115 Grain	**7mm TNT-HP**	**7mm HP**				
Sectional Density	0.195	0.204				
Ballistic Coefficient	0.338	0.257				
C.O.L. Tested At	3.300"	3.200"				
Speer Part No.	1616	1617				

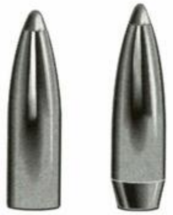
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**62.0C**	**3249**	**AA 3100**	**62.0C**	**3158**	**H380***	**49.0**	**2944**
	58.0	3057		58.0	2971		45.0	2731
IMR 4831	**60.0C**	**3246**	**IMR 4064**	**50.0**	**3115**	**Viht. N140**	**42.0**	**2841**
	56.0	3020		46.0	2865		38.0	2625
IMR 4350	**58.0**	**3245**	**760***	**57.0**	**3047**	**748***	**47.0**	**2839**
	54.0	3002		53.0	2776		43.0	2563
H4350	**59.0C**	**3176**	**IMR 4895**	**47.5**	**2978**	**AA 2520***	**39.0**	**2747**
	55.0	2880		43.5	2730		35.0	2566
AA 4350	**59.0C**	**3166**	**IMR 4320**	**44.0**	**2957**	**Re12**	**41.0**	**2729**
	55.0	2960		40.0	2793		37.0	2529

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia. **120 Grain** Sect. Density .213	**7mm Spitz-SP**					
Ballistic Coefficient	0.386					
C.O.L. Tested At	3.200"					
Speer Part No.	1620					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**59.0**	**3161**	**760***	**53.0**	**3068**	**IMR 3031**	**45.0**	**2932**
	55.0	2882		49.0	2828		41.0	2606
AA 4350	**57.0**	**3120**	**IMR 4350**	**54.0**	**3030**	**748***	**47.0**	**2913**
	53.0	2892		50.0	2826		43.0	2598
AA 3100	**61.0C**	**3110**	**H450***	**58.0**	**3021**	**H380***	**49.0**	**2878**
	57.0	2926		54.0	2761		45.0	2633
IMR 4831	**57.0**	**3109**	**IMR 4895**	**47.0**	**2983**	**Viht. N150**	**41.0**	**2793**
	53.0	2897		43.0	2687		37.0	2572
H1000*	**65.0C**	**3069**	**IMR 4064**	**47.0**	**2974**	**Re15**	**40.5**	**2786**
	61.0	2826		43.0	2664		36.5	2518

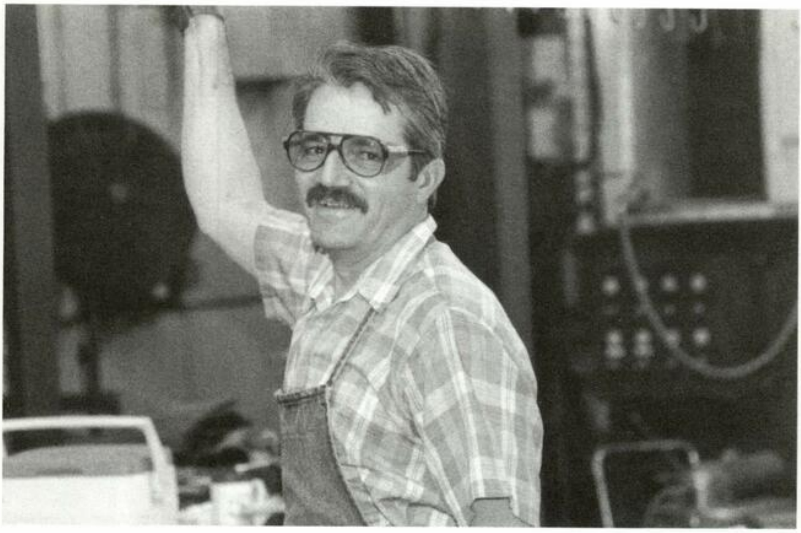
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**	**7mm BT Spitz-SP**				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	3.205"	3.205"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**59.0**	**3096**	**AA 4350**	**55.0**	**2965**	**Re15**	**43.0**	**2771**
	55.0	2823		51.0	2769		39.0	2532
IMR 4831	**58.0**	**3077**	**AA 3100**	**56.0**	**2909**	**H380***	**45.0**	**2733**
	54.0	2865		52.0	2682		41.0	2489
IMR 4350	**56.0**	**3075**	**760***	**52.0**	**2890**	**Viht. N150**	**42.0**	**2696**
	52.0	2845		48.0	2639		38.0	2440
H4350	**56.0**	**2993**	**H414***	**50.0**	**2879**	**IMR 4895**	**43.0**	**2695**
	52.0	2816		46.0	2622		39.0	2453
IMR 4064	**48.5**	**2967**	**IMR 4320**	**46.0**	**2876**	Reduced Load **SR 4759**	**24.0**	**2024**
	44.5	2720		42.0	2611		20.0	1680

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



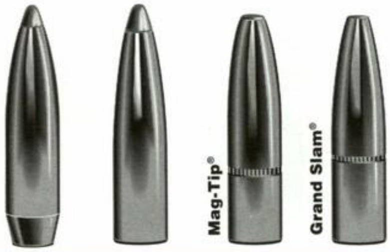
John Bauman, RCBS tool line employee.

.284" Dia. **145 Grain** Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**	**7mm GS-SP**		
Ballistic Coefficient	0.502	0.457	0.465	0.327		
C.O.L. Tested At	3.180"	3.160"	3.280"	3.275		
Speer Part No.	1628	1629	1631	1632		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**56.5**	**2976**	**AA 4350**	**52.0**	**2781**	**AA 3100**	**52.0**	**2701**
	52.5	2765		48.0	2580		48.0	2506
Re22	**55.0**	**2880**	**H4350**	**51.0**	**2763**	**760***	**50.0**	**2701**
	51.0	2664		47.0	2566		46.0	2467
Re19	**54.0**	**2849**	**IMR 4350**	**50.0**	**2752**	**H414***	**47.0**	**2639**
	50.0	2624		46.0	2540		43.0	2433
IMR 4064	**47.0**	**2820**	**IMR 4320**	**45.0**	**2706**	**H380***	**45.0**	**2600**
	43.0	2575		41.0	2432		41.0	2402
IMR 7828	**54.0**	**2799**	**IMR 4895**	**44.0**	**2706**	Reduced Load **SR 4759**	**25.0**	**2012**
	50.0	2605		40.0	2450		21.0	1689

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

TO DO IT SAFETY FIRST RIGHT



.284" Dia. **160 Grain** Sect. Density .283	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm MT-SP**	**7mm GS-SP**		
Ballistic Coefficient	0.556	0.502	0.354	0.387		
C.O.L. Tested At	3.200"	3.200"	3.265"	3.265"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**53.0**	**2755**	**H1000**	**53.0**	**2640**	**AA 3100**	**51.0**	**2595**
	49.0	2545		49.0	2423		47.0	2332
IMR 4831	**52.0**	**2724**	**H4350**	**50.0**	**2640**	**IMR 4320**	**44.0**	**2571**
	48.0	2511		46.0	2463		40.0	2352
Re22	**52.0**	**2699**	**IMR 4350**	**49.0**	**2638**	**IMR 4895**	**42.0**	**2521**
	48.0	2488		45.0	2420		38.0	2286
7828	**52.0**	**2664**	**AA 4350**	**50.0**	**2632**	**H414***	**46.0**	**2519**
	48.0	2454		46.0	2451		42.0	2267
Viht. N165	**53.0**	**2654**	**IMR 4064**	**44.0**	**2601**	Reduced Load **SR 4759**	**26.0**	**2008**
	49.0	2452		40.0	2370		22.0	1711

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Mag-Tip®
Grand Slam®

.284" Dia. **175 Grain** Sect. Density .310	**7mm MT-SP**	**7mm GS-SP**				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	3.320"	3.300"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**49.0**	**2586**	**IMR 4350**	**48.0**	**2480**	**H414***	**45.0**	**2403**
	45.0	2390		44.0	2320		41.0	2198
Re22	**50.0**	**2585**	**H4350**	**47.0**	**2476**	**IMR 4064**	**41.5**	**2382**
	46.0	2388		43.0	2315		37.5	2150
Re19	**50.0**	**2581**	**AA 3100**	**47.0**	**2423**	**IMR 4895**	**39.5**	**2327**
	46.0	2369		43.0	2234		35.5	2094
H1000	**53.0**	**2553**	**760***	**46.0**	**2421**	**SR 4759**	**25.0**	**1753**
	49.0	2381		42.0	2202		21.0	1490
IMR 7828	**50.0**	**2548**	**Viht. N165**	**48.0**	**2415**			
	46.0	2372		44.0	2303			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

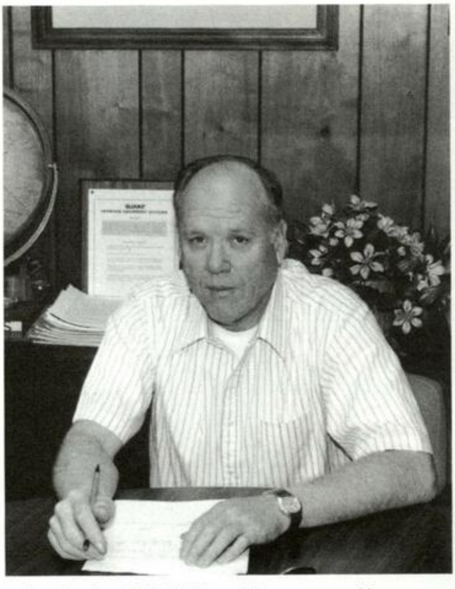
284 WINCHESTER

Introduced by Winchester in 1963, the 284 is an unusual cartridge because of its case design. The 284 was conceived as a compact cartridge which would match the performance of a 270 Winchester or 280 Remington but be better suited for lever-action and semi-automatic rifles. The cartridge was chambered in Winchester's Model 88 lever rifle and Model 100 autoloader.

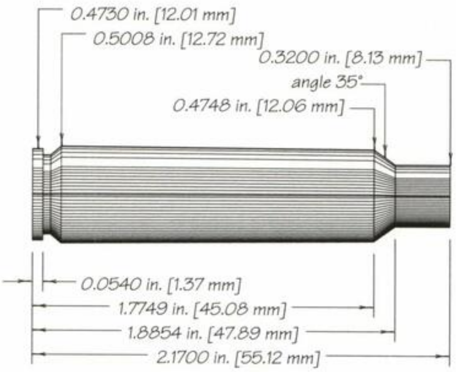
The case is classed as rebated rimless. The rim diameter is the same as the 30-06 rim, but the body is .030" larger to allow increased powder capacity. Although the case capacity of the 284 is similar to that of the 270 and 280, the short cartridge overall length requires that bullets be seated relatively deep which reduces effective capacity. Custom bolt-actions rifles, with the proper throating, could take better advantage of the 284's case capacity.

Winchester never chambered any bolt-action rifles in this caliber. Ruger and Browning at one time offered their bolt guns in 284 but at press time, no production rifles are now chambered for the 284. The 7mm-08 Remington will do anything that the 284 can yet with a standard case and less powder. Therefore, it appears that the 284 is headed for obsolescence.

When loading the 284 for semi-auto and lever-action rifles, reduce maximum loads by at least two grains to avoid extraction problems. The following loads do not exceed the SAAMI maximum average pressure of 54,000 cup.



Lee Squires, RCBS Plant Manager, working to ensure the RCBS traditions of quality products and service remain paramount.



0.4730 in. [12.01 mm]
0.5008 in. [12.72 mm]
0.3200 in. [8.13 mm]
angle 35°
0.4748 in. [12.06 mm]
0.0540 in. [1.37 mm]
1.7749 in. [45.08 mm]
1.8854 in. [47.89 mm]
2.1700 in. [55.12 mm]

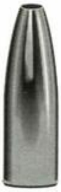
Max. Case Length: 2.170"
Trim-to Length: 2.160"
Max. Cart. Length: 2.800"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-8.75"

Test Firearm: Ruger Model 77
Case: W-W
Primers: CCI 200, 250

.284" Dia. **110 Grain** Sect. Density .195	**7mm TNT-HP**					
Ballistic Coefficient	0.338					
C.O.L. Tested At	2.780"					
Speer Part No.	1616					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**62.0C**	**3438**	**BL-C(2)***	**56.0**	**3345**	**IMR 4831**	**62.0**	**3200**
	58.0	3207		52.0	3074		58.0	2973
Re15	**57.0**	**3384**	**H414***	**61.0C**	**3341**	**Re19**	**62.0**	**3159**
	53.0	3136		57.0	3107		58.0	2934
AA 2460*	**52.0**	**3354**	**Viht. N135**	**52.0**	**3282**	**H4350**	**59.0**	**3090**
	48.0	3075		48.0	3003		55.0	2879
748*	**57.0**	**3352**	**IMR 4350**	**60.0**	**3220**	**AA 4350**	**59.0**	**3069**
	53.0	3087		56.0	3001		55.0	2860

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

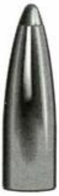


.284" Dia.
115 Grain

Sect. Density .204

	7mm HP					
Ballistic Coefficient	0.257					
C.O.L. Tested At	2.770"					
Speer Part No.	1617					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**59.0**	**3167**	**IMR 4064**	**50.0**	**2992**	**IMR 4320**	**50.0**	**2910**
	55.0	2952		46.0	2751		46.0	2697
IMR 4831	**60.0**	**3143**	**748***	**51.0**	**2950**			
	56.0	2919		47.0	2716			
760*	**57.0**	**3122**	**H450***	**60.0C**	**2939**			
	53.0	2914		56.0	2728			



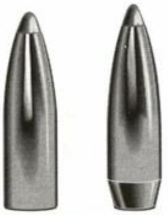
.284" Dia.
120 Grain

Sect. Density .213

	7mm Spitz-SP					
Ballistic Coefficient	0.386					
C.O.L. Tested At	2.800"					
Speer Part No.	1620					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**61.0C**	**3283**	**AA 2460***	**51.0**	**3199**	**H335***	**53.0**	**3128**
	57.0	3062		47.0	2965		49.0	2948
IMR 4350	**61.0C**	**3240**	**BL-C(2)***	**54.0**	**3173**	**H380***	**57.0**	**3106**
	57.0	3027		50.0	2966		53.0	2900
IMR 4831	**62.0**	**3211**	**IMR 4064**	**53.0**	**3161**	**Re12**	**52.0**	**3105**
	58.0	2975		49.0	2905		48.0	2843
760*	**59.0**	**3203**	**IMR 3031**	**51.0**	**3154**	**H450***	**60.0C**	**2989**
	55.0	2973		47.0	2903		56.0	2807
748*	**55.0**	**3199**	**IMR 4895**	**51.0**	**3129**	Reduced Load **AA 3100**	**61.0C**	**2934**
	51.0	2989		47.0	2904		57.0	2716

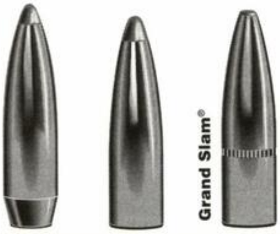
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.284" Dia.
130 Grain
Sect. Density .230

	7mm Spitz-SP	7mm BT Spitz-SP				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	2.800"	2.800"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**58.0**	**3100**	**IMR 4064**	**49.0**	**2841**	Reduced Load **SR 4759**	**24.0**	**2029**
	54.0	2893		45.0	2606		20.0	1694
IMR 4831	**59.0**	**3039**	**748***	**50.0**	**2895**			
	55.0	2846		46.0	2661			
760*	**56.0**	**3003**	**H450***	**58.0**	**2850**			
	52.0	2779		54.0	2649			

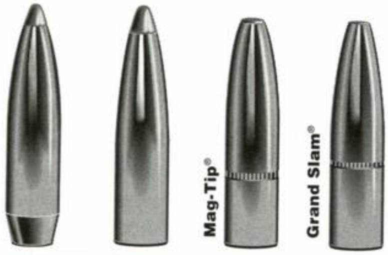


.284" Dia.
145 Grain
Sect. Density .257

	7mm BT Spitz-SP	7mm Spitz-SP	7mm GS-SP			
Ballistic Coefficient	0.502	0.457	0.327			
C.O.L. Tested At	2.800"	2.800"	2.800"			
Speer Part No.	1628	1629	1632			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**56.0**	**2940**	**760***	**54.0**	**2846**	Reduced Load **SR 4759**	**25.0**	**1980**
	52.0	2744		50.0	2629		21.0	1666
IMR 4831	**57.0**	**2907**	**H450***	**57.0**	**2770**			
	53.0	2720		53.0	2573			
IMR 4895	**48.0**	**2862**	**IMR 4064**	**47.0**	**2712**			
	44.0	2601		43.0	2488			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

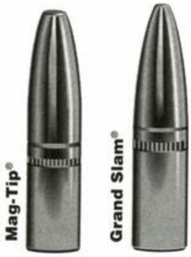


.284" Dia. 160 Grain

Sect. Density .284

	7mm BT Spitz-SP	7mm Spitz-SP	7mm MT-SP	7mm GS-SP		
Ballistic Coefficient	0.556	0.502	0.354	0.415		
C.O.L. Tested At	2.800"	2.800"	2.800"	2.800"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**54.0C**	**2808**	H450	**55.0**	**2661**	Reduced Load IMR 4198	**27.0**	**1968**
	50.0	2587		51.0	2440		23.0	1674
IMR 4831	**55.0C**	**2765**	IMR 4064	**45.0**	**2610**			
	51.0	2580		41.0	2372			
760*	**52.0**	**2703**	748*	**46.0**	**2610**			
	48.0	2479		42.0	2388			



.284" Dia. 175 Grain

Sect. Density .310

	7mm MT-SP	7mm GS-SP				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	2.800"	2.800"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**53.0C**	**2638**	760*	**49.0**	**2493**	Reduced Load IMR 4198	**28.0**	**1949**
	49.0	2451		45.0	2274		24.0	1668
IMR 4350	**52.0C**	**2618**	IMR 4064	**42.5**	**2392**			
	48.0	2427		38.5	2169			
H450*	**54.0C**	**2532**	IMR 4320	**42.0**	**2314**			
	50.0	2345		38.0	2093			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

7mm REMINGTON MAGNUM

This is one of the most successful Magnum rifle cartridges ever developed. Prior to its introduction in 1962, there were a number of excellent 7mm proprietary, wildcat and foreign cartridges based on the shortened 300 H&H Magnum belted case including the 7mm Weatherby, the 7mm Mashburn and the 7x61mm Sharpe & Hart.

The problem with some of these cartridges was that they were only available in expensive imported or custom rifles and usually required that the owner be a handloader willing to form cases. Only the 7mm Weatherby was available in factory rifles and with factory ammo.

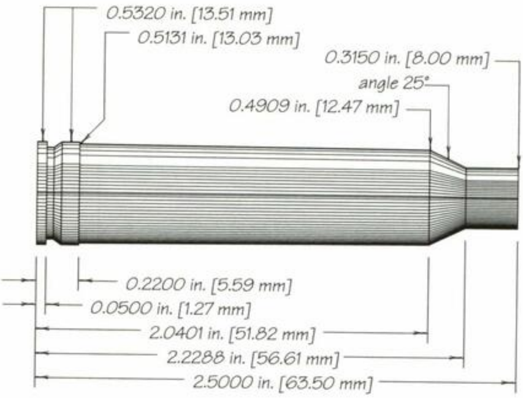
Remington took the best features of the other 7mm Magnums and introduced their 7mm Magnum in their popularly-priced Model 700 bolt-action rifle. Shooters' acceptance was almost immediate. The excellent sectional density of 7mm bullets and the velocity potential of the cartridge combine to make a hard-hitting, flat-shooting cartridge which is deadly on most species of North American game. Many experienced hunters feel any 7mm bore is too light for the great bears; however, some people use the 7mm Magnum on the big bruins anyway. The 7mm Magnum has also proved its worth on African plains animals.

The 7mm Remington Magnum is at its best when taking long shots on deer, sheep and elk. With 160 and 175 grain bullets, retained energy is high and accuracy is sufficient to insure hits at longer ranges. Speer recommends that the 145 grain and lighter bullets (with the exception of the 145 grain Grand Slam) be limited to game the size of antelope or smaller. The high velocity of the 7mm Magnum can cause light bullets to break up on tissue resulting in shallow penetration on larger deer.

There is quite a variation in published loading data for this caliber. Differences in cases, primers, and bullets all have an effect. This emphasizes our constant caution to ALWAYS reduce loads whenever changing components from those used to develop the data.

Seldom will either handloads or factory ammunition match nominal factory ballistics in a sporting rifle and there is a great deal of velocity variation among sporters in this caliber. Because of this, we have departed from our usual policy of showing velocities from a sporter. The velocities for the 7mm Remington Magnum are from the 24 inch pressure barrel.

These loads stay within the industry pressure limit of 52,000 cup.


0.5320 in. [13.51 mm]
0.5131 in. [13.03 mm]
0.3150 in. [8.00 mm]
angle 25°
0.4909 in. [12.47 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.0401 in. [51.82 mm]
2.2288 in. [56.61 mm]
2.5000 in. [63.50 mm]

Max. Case Length: 2.500"
Trim-to Length: 2.490"
Max. Cart. Length: 3.290"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-9.5"

Test Firearm: Universal Receiver
Case: R-P
Primers: CCI 250

110 Grain
115 Grain

Note: TNT not recommended for velocities exceeding 3500 fps.

.284" Dia. 110 Grain 115 Grain	**7mm TNT-HP**	**7mm Spitz-SP**				
Sectional Density	0.195	0.204				
Ballistic Coefficient	0.338	0.257				
C.O.L. Tested At	3.250"	3.200"				
Speer Part No.	1616	1617				

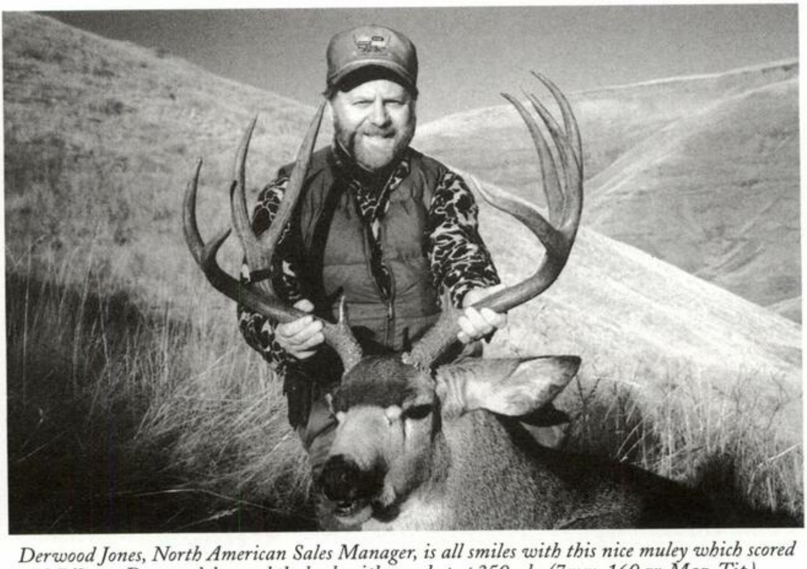
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**75.0C**	**3503**	**AA 4350***	**67.0**	**3427**	**AA 3100***	**73.0C**	**3358**
	71.0	3265		63.0	3255		69.0	3160
Re19*	**74.0C**	**3489**	**IMR 4831***	**71.0**	**3412**	**760***	**65.0**	**3323**
	70.0	3237		67.0	3208		61.0	3117
Viht. N165*	**77.0C**	**3481**	**H4831***	**72.0**	**3392**	**H450***	**69.0**	**3285**
	73.0	3275		68.0	3195		65.0	3094
H4350*	**67.0C**	**3451**	**IMR 4350***	**66.0**	**3379**	**Re15***	**58.0**	**3256**
	63.0	3227		62.0	3211		54.0	3034

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia. **120 Grain** Sect. Density .213	**7mm Spitz-SP**					
Ballistic Coefficient	0.386					
C.O.L. Tested At	3.250"					
Speer Part No.	1620					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**73.0**	**3435**	**H4831***	**74.0C**	**3357**	**Re15***	**56.0**	**3245**
	69.0	3177		70.0	3125		52.0	2956
Viht. N165*	**76.0**	**3389**	**IMR 4350***	**63.0**	**3328**	**IMR 4064***	**54.0**	**3233**
	72.0	3158		59.0	3161		50.0	2925
H4350*	**64.0C**	**3387**	**IMR 4831***	**65.0**	**3310**	**H414***	**61.0**	**3232**
	60.0	3190		61.0	3104		57.0	3005
AA 4350*	**64.0**	**3384**	**AA 3100***	**69.0**	**3308**	**IMR 4895***	**53.0**	**3230**
	60.0	3140		65.0	3112		49.0	2970
Re19*	**72.0**	**3384**	**760***	**61.0**	**3292**	**H380***	**59.0**	**3189**
	68.0	3158		57.0	3045		55.0	2917

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

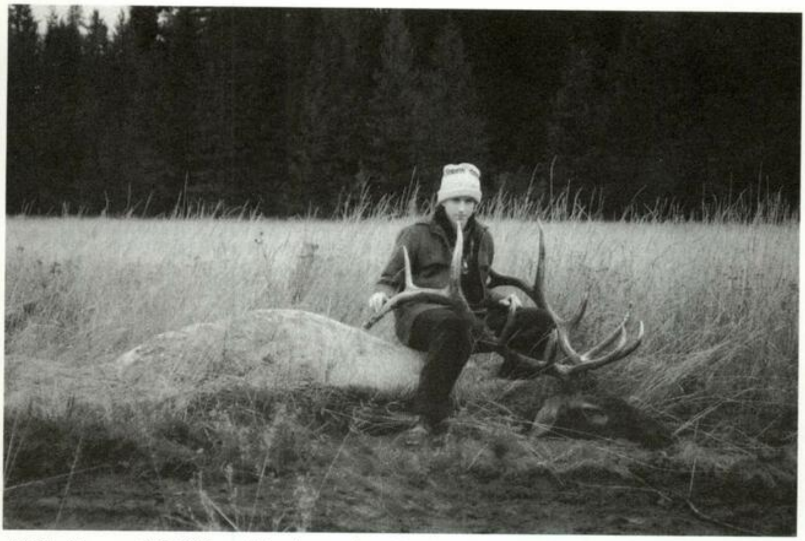


Derwood Jones, North American Sales Manager, is all smiles with this nice muley which scored 179 7/8 pts. Derwood dropped the buck with one shot at 350 yds. (7mm, 160 gr. Mag-Tip)

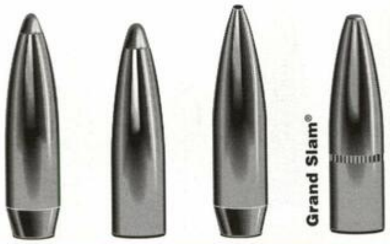
.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**	**7mm BT Spitz-SP**				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	3.285"	3.285"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**70.0**	**3314**	**AA 4350***	**64.0**	**3227**	**H380***	**59.0**	**3052**
	66.0	3118		60.0	3027		55.0	2841
Re19*	**69.0**	**3270**	**760***	**62.0**	**3211**	**Re15***	**55.0**	**3049**
	65.0	3057		58.0	2989		51.0	2814
IMR 4831*	**65.0**	**3243**	**H4831***	**69.0C**	**3195**	**IMR 4895***	**50.0**	**2964**
	61.0	3044		65.0	2980		46.0	2737
IMR 4350*	**63.0**	**3234**	**H4350***	**64.0**	**3189**	Reduced Load **SR 4759***	**26.0**	**2084**
	59.0	3040		60.0	3004		22.0	1768
Viht. N165*	**72.0**	**3231**	**H414***	**62.0**	**3164**			
	68.0	3017		58.0	2960			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



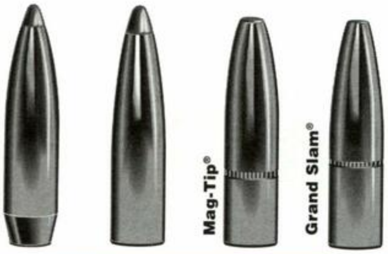
Ti Smith, son of CCI/Speer Plastics employee Lou Marvin, with the huge bull elk he shot in the Lewiston, Idaho area. (7mm, 160 gr. Grand Slam)



.284" Dia. 145 Grain Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**	**7mm GS-SP**		
Ballistic Coefficient	0.502	0.457	0.465	0.327		
C.O.L. Tested At	3.280"	3.280"	3.290"	3.235"		
Speer Part No.	1628	1629	1631	1632		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19*	**67.0**	**3153**	**H450***	**62.0**	**3075**	**760***	**58.0**	**3012**
	63.0	2948		58.0	2890		54.0	2819
Re22*	**68.0**	**3136**	**IMR 4350***	**60.0**	**3070**	**AA 3100***	**66.0**	**3008**
	64.0	2919		56.0	2881		62.0	2826
IMR 7828*	**69.0**	**3103**	**H870***	**80.0C**	**3037**	**H4350***	**63.0**	**2987**
	65.0	2974		76.0	2860		59.0	2801
H1000*	**73.0C**	**3090**	**Viht. N165***	**68.0**	**3019**	**H4831***	**65.0**	**2981**
	69.0	2910		64.0	2828		61.0	2781
IMR 4831*	**63.0**	**3081**	**AA 4350***	**64.0**	**3015**	Reduced Load **SR 4759***	**28.0**	**2112**
	59.0	2920		60.0	2837		24.0	1811

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

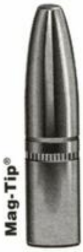


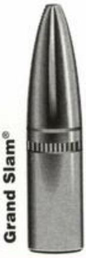
.284" Dia. **160 Grain** Sect. Density .283	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm MT-SP**	**7mm GS-SP**		
Ballistic Coefficient	0.556	0.502	0.354	0.387		
C.O.L. Tested At	3.280"	3.280"	3.225"	3.225"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**65.0**	**2976**	**H4350***	**61.0**	**2904**	**AA 4350***	**61.0**	**2849**
	61.0	2773		57.0	2735		57.0	2680
H870*	**79.0**	**2970**	**IMR 4350***	**58.0**	**2901**	**H4831***	**61.0**	**2846**
	75.0	2819		54.0	2725		57.0	2661
Re19*	**64.0**	**2941**	**AA 8700***	**79.0**	**2870**	**IMR 4320***	**53.0**	**2782**
	60.0	2729		75.0	2736		49.0	2542
H1000*	**69.0**	**2936**	**AA 3100***	**64.0**	**2869**	**760***	**55.0**	**2757**
	65.0	2761		60.0	2691		51.0	2374
IMR 4831*	**61.0**	**2915**	**Viht. N165***	**64.0**	**2867**	Reduced Load **SR 4759***	**30.0**	**2067**
	57.0	2784		60.0	2692		26.0	1770

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

7mm REMINGTON MAGNUM





.284" Dia. 175 Grain Sect. Density .310	7mm MT-SP	7mm GS-SP				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	3.280"	3.260"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H870*	**78.0**	**2954**	**H1000***	**65.0**	**2782**	**H4350***	**59.0**	**2703**
	74.0	2790		61.0	2620		55.0	2546
Re22*	**61.0**	**2830**	**Viht. N165***	**62.0**	**2742**	**IMR 7828***	**65.0**	**2667**
	57.0	2618		58.0	2565		61.0	2529
IMR 4831*	**59.0**	**2827**	**AA 8700***	**75.0**	**2722**	**IMR 4320***	**51.0**	**2655**
	55.0	2641		71.0	2639		47.0	2445
Re19*	**62.0**	**2812**	**H450***	**60.0**	**2717**	Reduced Load **SR 4759***	**32.0**	**2085**
	58.0	2604		56.0	2562		28.0	1831
IMR 4350*	**56.0**	**2789**	**AA 4350***	**59.0**	**2713**			
	52.0	2630		55.0	2547			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

7mm WEATHERBY MAGNUM

Roy Weatherby developed this fine cartridge in the 1940's, but it didn't get a lot of exposure until the early part of the next decade when Weatherby rifles became more available. It is a fine cartridge for the one-rifle hunter who routinely hunts open country. For years, it was the premier 7mm Magnum and the only one for which factory rifles were available until the 7mm Remington Magnum appeared in 1962.

Ballistically, it is nearly identical to the newer Remington Magnum. Reloaders who like cartridges with long necks will appreciate the Weatherby version but, in terms of field performance, there is little difference. Choosing between the two is more a matter of which rifle you like best.

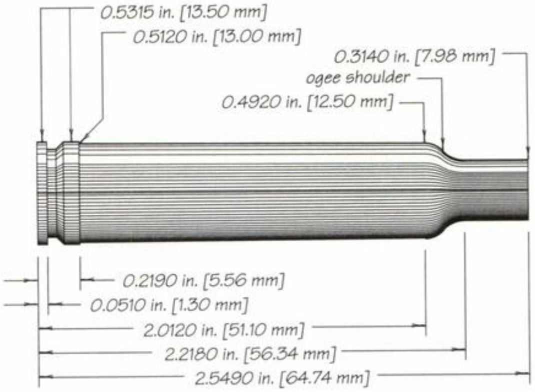
Reloading is necessary to get maximum flexibility from the 7mm Weatherby. Factory ammunition is loaded with 139 and 154 grain bullets. The cartridge easily handles the full range of bullet weights available to the handloader, which makes this cartridge very useful for a wide range of hunting applications.

Like the Remington Magnum, the 7mm Weatherby has taken game of all shapes and sizes around the world. The same classes of game can be taken with either cartridge and neither has an advantage over the other for long shots. Because the 7mm Weatherby produces high velocity, we recommend bullets of tough construction such as Grand Slam and Mag-Tip for heavier game. Remember that lightweight bullets at high velocity in this cartridge and other 7mm Magnums may cause quite a bit of meat damage on medium deer. A way to reduce this is to stay with heavier (160 grains and up) bullets when hunting to fill the freezer.

Although the 7mm Weatherby isn't considered a varmint cartridge, accuracy with the 115 grain hollow point and 120 grain soft is excellent, allowing long-range hits on varmints. We did not show loads for the 110 grain TNT hollow point because velocities are slightly over the TNT's limit of 3500 ft/sec.

IMPORTANT NOTE: We used Remington cases for data development. These cases have slightly less powder capacity than Weatherby brass. The listed loads are safe in either make of case. However, if you have a pet load developed in Weatherby brass, you should drop the charge weight at least two grains before switching to Remington cases.

These loads were tested, by case head expansion and were quite safe in our test rifle. Norma of Sweden reports a pressure of 55,100 psi for this cartridge.


0.5315 in. [13.50 mm]
0.5120 in. [13.00 mm]
0.3140 in. [7.98 mm]
ogee shoulder
0.4920 in. [12.50 mm]
0.2190 in. [5.56 mm]
0.0510 in. [1.30 mm]
2.0120 in. [51.10 mm]
2.2180 in. [56.34 mm]
2.5490 in. [64.74 mm]

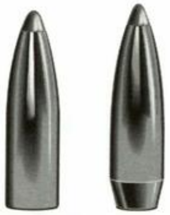
Max. Case Length: 2.549"
Trim-to Length: 2.539"
Max. Cart. Length: 3.360"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: R-P
Primers: CCI 250

.284" Dia. 115 Grain 120 Grain	7mm HP	7mm Spitz-SP				
Sectional Density	0.204	0.213				
Ballistic Coefficient	0.257	0.386				
C.O.L. Tested At	2.550"	2.550"				
Speer Part No.	1617	1620				

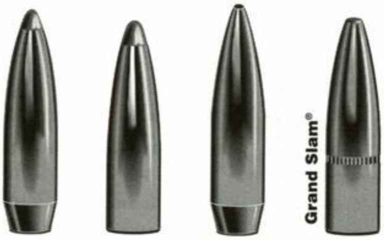
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**76.0**	**3536**	IMR 7828*	**77.0**	**3462**	AA 3100*	**74.0**	**3385**
	72.0	3350		73.0	3282		70.0	3202
Viht. N160*	**73.0**	**3491**	IMR 4350*	**71.0**	**3456**	Re15*	**63.0**	**3383**
	69.0	3300		67.0	3261		59.0	3169
Viht. N165*	**77.0**	**3475**	H4831*	**76.0**	**3413**	Re19*	**74.0**	**3381**
	73.0	3295		72.0	3234		70.0	3198

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**	**7mm BT Spitz-SP**				
Ballistic Coefficient	0.394	0.411				
C.O.L. Tested At	3.330"	3.330"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**76.0**	**3455**	**AA 3100***	**73.0**	**3322**	**Viht. N160***	**72.0**	**3313**
	72.0	3273		69.0	3140		68.0	3129
IMR 7828*	**76.0**	**3387**	**Re19***	**72.5**	**3318**	**IMR 4350***	**70.0**	**3282**
	72.0	3209		68.5	3135		66.0	3095
H4831*	**75.0**	**3331**	**Viht. N165***	**75.0**	**3313**	**IMR 4831***	**72.0**	**3271**
	71.0	3153		71.0	3136		68.0	3089



.284" Dia. **145 Grain** Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**	**7mm GS-SP**		
Ballistic Coefficient	0.502	0.457	0.465	0.327		
C.O.L. Tested At	3.340"	3.360"	3.360"	3.290"		
Speer Part No.	1628	1629	1631	1632		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N165*	**74.0**	**3183**	**Re19***	**70.0**	**3100**	**Viht. N160***	**71.5**	**3051**
	70.0	3011		66.0	2923		67.5	2881
H1000*	**77.0**	**3182**	**IMR 4350***	**67.5**	**3098**	**AA 8700***	**82.5**	**3004**
	73.0	3017		63.5	2914		78.5	2858
Re22*	**72.5**	**3181**	**H4350***	**68.0**	**3075**	**IMR 4064***	**58.0**	**2958**
	68.5	3005		64.0	2894		54.0	2755
H4831*	**73.0**	**3174**	**AA 3100***	**70.0**	**3060**	Reduced Load **SR 4759***	**29.0**	**1970**
	69.0	3000		66.0	2885		25.0	1689
IMR 7828*	**73.0**	**3127**	**IMR 4831***	**69.0**	**3052**			
	69.0	2956		65.0	2875			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Mag-Tip®
Grand Slam®

.284" Dia.
160 Grain
Sect. Density .283

	7mm BT Spitz-SP	7mm Spitz-SP	7mm MT-SP	7mm GS-SP		
Ballistic Coefficient	0.556	0.502	0.354	0.387		
C.O.L. Tested At	3.360"	3.360"	3.360"	3.360"		
Speer Part No.	1634	1635	1637	1638		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**72.0**	**3082**	**H4831***	**71.0**	**3003**	**AA 8700***	**82.0**	**2938**
	68.0	2911		67.0	2834		78.0	2795
Re22*	**70.5**	**3079**	**Viht. N165***	**71.0**	**2989**	Reduced Load **SR 4759***	**31.0**	**2001**
	66.5	2905		67.0	2821		27.0	1727
IMR 4350*	**65.5**	**3020**	**IMR 4831***	**67.0**	**2987**			
	61.5	2835		63.0	2809			
H1000*	**75.5**	**3017**	**AA 3100***	**69.0**	**2952**			
	71.5	2857		65.0	2781			

Mag-Tip®
Grand Slam®

.284" Dia.
175 Grain
Sect. Density .310

	7mm MT-SP	7mm GS-SP				
Ballistic Coefficient	0.385	0.465				
C.O.L. Tested At	3.360"	3.360"				
Speer Part No.	1641	1643				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
7828*	**71.0**	**2940**	**IMR 4350***	**64.5**	**2835**	**H4350***	**63.0**	**2763**
	67.0	2774		60.5	2659		59.0	2588
H4831*	**70.0**	**2925**	**H450***	**66.0**	**2834**	**AA 3100***	**66.0**	**2762**
	66.0	2758		62.0	2662		62.0	2595
Viht. Re22*	**67.5**	**2866**	**IMR 4831***	**65.0**	**2784**	**AA 8700***	**77.0**	**2706**
	63.5	2696		61.0	2613		73.0	2565
Viht. N165*	**69.0**	**2838**	**H1000***	**71.0**	**2783**	Reduced Load **SR 4759***	**32.0**	**1977**
	65.0	2674		67.0	2626		28.0	1702

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

30 M1 CARBINE

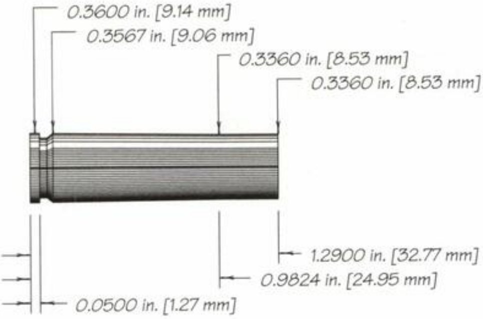
Shortly before World War II, Army Ordnance determined that certain military units might be better off with a light carbine instead of the 45 caliber service pistol. The cartridge developed for this purpose was a small-capacity, rimless design which fired a 110 grain full metal jacket bullet at just under 2000 feet/sec. In spite of its relatively anemic performance, the cartridge and its rifle, the U.S. Model M1 Carbine, gave reliable service in two wars. A selective-fire version, the M2, was also manufactured.

Generally, surplus carbines are not known for impressive accuracy and the cartridge is much too underpowered for deer. However, the carbine has remained popular with civilians for its light weight and recoil, and its ease of handling. In short, it's just plain fun to shoot! It shouldn't be used on any animals larger than a coyote.

There seem to be a lot of shooters who reload for the 30 Carbine in spite of the availability of surplus ammunition. For a while, carbines were rather expensive on the collectors' market. However, the recent importation of a new batch of surplus carbines has made them quite affordable. There are also several commercial copies of the military version.

The full metal jacket military bullet does not expand and thus lacks the stopping power of commercial ammo or handloads with expanding bullets. The handloader can chose from four Speer bullets. The 110 FMJ can be used to duplicate the military load or for small game loads where minimal meat damage is required. The 100 grain Plinker® is an inexpensive bullet for either practice or small game hunting. The large, exposed lead tip expands rapidly although penetration is usually quite limited. For deeper penetration, choose the 110 grain Hot-Cor soft point. The 110 grain Varminter® hollow point also very popular. The choice of bullet may be limited by the condition of your carbine. Some have rough feed rams and thus show a strong preference for the FMJ and Hot-Cor bullets.

Slow-burning pistol powders and fast rifle powders are the only ones appropriate for loading the 30 Carbine cartridge. They give adequate gas volume to cycle the gas-operated action of the Carbine. This cartridge headspaces on the case mouth, so taper crimping is strongy recommended. These loads do not exceed the SAAMI maximum average pressure of 40,000 cup.


0.3600 in. [9.14 mm]
0.3567 in. [9.06 mm]
0.3360 in. [8.53 mm]
0.3360 in. [8.53 mm]
1.2900 in. [32.77 mm]
0.9824 in. [24.95 mm]
0.0500 in. [1.27 mm]

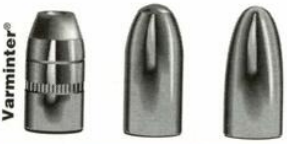
Max. Case Length: 1.290"
Trim-to Length: 1.280"
Max. Cart. Length: 1.680"
RCBS Shellholder: #17
Barrel Length: 18"
Twist: 1-16"

Test Firearm: M1 Carbine
Case: IMI
Primers: CCI 400, 450, No. 41

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	1.625"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #9	**14.3**	**2185**	IMR 4227	**15.5**	**1946**	IMR 4198	**15.5C**	**1685**
	12.3	1908		13.5	1693		13.5	1459
296*	**15.5**	**2010**	Viht. N110	**13.0C**	**1939**	AA 1680	**16.0C**	**1677**
	13.5	1756		11.0	1696		14.0	1465
H110*	**14.5**	**1951**	2400	**12.5**	**1817**			
	12.5	1678		10.5	1526			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder. The No. 41 primer may be substituted for the Magnum Primer.



.308" Dia. **110 Grain** Sect. Density .166	**30** **HP**	**30** **RN-SP**	**30 Carb.** **RN-FMJ**			
Ballistic Coefficient	0.136	0.144	0.179			
C.O.L. Tested At	1.635"	1.675"	1.680"			
Speer Part No.	1835	1845	1846			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**15.0**	**1981**	**IMR 4227**	**15.0**	**1883**	**SR 4759**	**12.0**	**1678**
	13.0	1796		13.0	1627		10.0	1497
AA #9	**13.4**	**1950**	**Viht. N110**	**12.5C**	**1822**	**AA 1680**	**16.0C**	**1674**
	11.4	1739		10.5	1567		14.0	1468
H110*	**14.0**	**1885**	**2400***	**12.0**	**1745**	**IMR 4198**	**15.0C**	**1631**
	12.0	1610		10.0	1469		13.0	1428

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder. The No. 41primer may be substituted for the Magnum Primer.

30-30 WINCHESTER

[These loads can also be used in the 30 Remington cartridge]

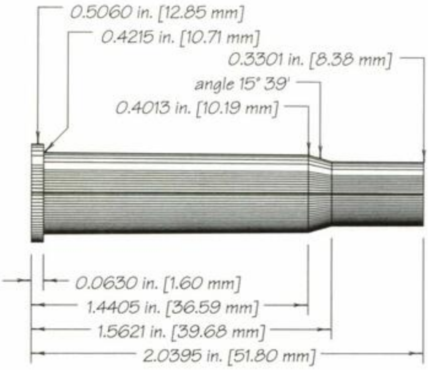
The 30-30 cartridge has the distinction of being the first American small-bore sporting cartridge loaded with smokeless propellant. It was introduced in 1895 in the famous Winchester Model 1894 lever-action rifle and was an immediate success. The new rifle was just as light and handy as the earlier Model 1892 but could handle much more powerful cartridges. The Model 94 gave the hunter modern power (for 1895) in a compact, easily-carried package. Although under-powered by today's standards, the 30-30 is often chosen as the first deer rifle by new shooters.

If we judged cartridges by ballistics alone, the 30-30 would be merely a fond memory today. However, the combination of mild recoil and the traditional look and feel of the Model 94 and similar rifles helped keep the 30-30 popular. Most American rifle makers have offered the 30-30 at some time, usually in lever- or slide-action rifles.

For rifles having tubular magazines, the 30-30 must be loaded with flat point bullets. This prevents cartridge detonation in the magazine during recoil. Speer makes four flat point bullets suitable for the 30-30 ranging in weights from 110 to 170 grains. These bullets are designed to give optimum expansion at modest velocities. They all have a cannelure to allow secure crimping of the bullet. Crimping is mandatory for cartridges going into tubular magazines so that bullets are not pressed into the case by recoil and the tension of the magazine spring. The 170 grain Hot-Cor is the best choice for game up to medium-size deer, which is the effective game limit of the cartridge. When using the 100 grain Speer "Plinker", we recommend that they be fed singly into the barrel. The short overall cartridge length may cause feeding problems in tubular magazines and the magazine spring can push bullets deeper into the case. The 110 grain Varminter hollow point should be crimped in the rear cannelure for reliable feeding.

Some bolt-action and single-shot rifles have been chambered for this cartridge. Reloaders can use spitzer-type bullets in these rifles, but should keep the weight to 150 grains or less. Heavier spitzer bullets cannot be driven fast enough in the 30-30 to expand reliably. We are occasionally asked if the 30-30 can be loaded to higher velocities in a modern bolt action like the Remington Model 788. The answer is NO! The 30-30 case is an old design with relatively thin walls. Attempting to load "hotter" would risk a dangerous case failure.

The listed loads do not exceed the industry maximum average pressure of 38,000 cup. The data for round nose and flat point bullets can also be used in the 30 Remington cartridge, a rimless version of the 30-30 designed for Remington semi-automatic and slide-action rifles. Spitzer bullets may be used in the Models 8 and 81 rifles chambered for 30 Remington because they have box magazines.


0.5060 in. [12.85 mm]
0.4215 in. [10.71 mm]
0.3301 in. [8.38 mm]
angle 15° 39'
0.4013 in. [10.19 mm]
0.0630 in. [1.60 mm]
1.4405 in. [36.59 mm]
1.5621 in. [39.68 mm]
2.0395 in. [51.80 mm]

Max. Case Length: 2.0395"
Trim-to Length: 2.0295"
Max. Cart. Length: 2.550"
RCBS Shellholder: #2
Barrel Length: 20"
Twist: 1-12"

Test Firearm: Winchester 94
Case: W-W
Primers: CCI 200, 250
Comments: Do not use pointed bullets in tubular magazines.

Note: C.O.L. less than SAAMI minimum—we recommend single loading into the chamber.

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.345"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**35.0**	**2792**	**IMR 4064**	**37.5C**	**2527**	**748***	**40.0C**	**2483**
	31.0	2457		33.5	2173		36.0	2111
H322	**37.0**	**2730**	**Re12**	**39.0C**	**2521**	**Viht. N133**	**32.0**	**2405**
	33.0	2375		35.0	2218		28.0	2140
AA 2015BR	**35.0**	**2658**	**BL-C(2)***	**38.0**	**2497**	**H4895**	**35.0**	**2388**
	31.0	2366		34.0	2172		31.0	2054

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. 110 Grain

Sect. Density .166

	30 HP					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.415"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**34.0**	**2708**	**IMR 4064**	**37.0C**	**2460**	**IMR 4350**	**40.0C**	**2298**
	30.0	2302		33.0	2091		36.0	1976
H322	**35.0**	**2593**	**IMR 4895**	**35.0**	**2415**	**AA 2230**	**31.0**	**2296**
	31.0	2230		31.0	2101		27.0	1998
AA 2015BR	**34.0**	**2591**	**Viht. N133**	**31.0**	**2362**	**AA 2460***	**32.0**	**2259**
	30.0	2254		27.0	1934		28.0	1988
748*	**40.0C**	**2564**	**H380***	**39.0C**	**2309**	**760***	**39.0C**	**2204**
	36.0	2256		35.0	2055		35.0	1962
Re12	**38.0C**	**2492**	**H4895**	**34.0C**	**2300**	**H414***	**39.0C**	**2201**
	34.0	2218		30.0	1955		35.0	1871

.308" Dia. 130 Grain

Sect. Density .196

	30 Flat-SP					
Ballistic Coefficient	0.248					
C.O.L. Tested At	2.550"					
Speer Part No.	2007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2520*	**35.0C**	**2433**	**Re15**	**36.0C**	**2259**	**IMR 4895**	**32.0**	**2134**
	31.0	2068		32.0	1943		28.0	1857
AA 2460*	**34.0**	**2425**	**Viht. N140**	**35.0C**	**2257**	**760***	**38.0C**	**2133**
	30.0	2086		31.0	1964		34.0	1856
Re7	**31.0**	**2393**	**748***	**35.5**	**2221**	**H414***	**38.0**	**2102**
	27.0	2106		31.5	1866		34.0	1850
H322	**33.0**	**2367**	**Re12**	**34.0**	**2158**	**IMR 4064**	**33.0**	**2067**
	29.0	2036		30.0	1813		29.0	1757

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia.
150 Grain
Sect. Density .226

	30 Flat-SP					
Ballistic Coefficient	0.268					
C.O.L. Tested At	2.550"					
Speer Part No.	2011					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**37.0C**	**2238**	**Viht. N140**	**34.0**	**2156**	**H4895**	**31.0**	**2041**
	33.0	1925		30.0	1854		27.0	1674
H322	**31.0**	**2219**	**Re12**	**33.0**	**2128**	**IMR 4895**	**31.0**	**2018**
	27.0	1886		29.0	1788		27.0	1698
AA 2520*	**32.0**	**2192**	**H335***	**32.0**	**2111**	**IMR 4350**	**36.0C**	**2012**
	28.0	1863		28.0	1731		32.0	1690
Re7	**29.0**	**2188**	**H414***	**38.0C**	**2078**	**760***	**36.0C**	**1981**
	25.0	1882		34.0	1725		32.0	1644
Re15	**34.0C**	**2170**	**IMR 4320**	**33.0**	**2047**	**H380***	**34.0C**	**1970**
	30.0	1823		29.0	1699		30.0	1675

.308" Dia.
170 Grain
Sect. Density .256

	30 Flat-SP					
Ballistic Coefficient	0.304					
C.O.L. Tested At	2.550"					
Speer Part No.	2041					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**34.0**	**2118**	**IMR 4064**	**31.0**	**1964**	**AA 2460***	**28.0**	**1871**
	30.0	1833		27.0	1654		24.0	1590
H322	**29.0**	**2005**	**760***	**35.0**	**1946**	**H4831***	**38.0C**	**1868**
	25.0	1684		31.0	1635		34.0	1603
H335*	**31.0**	**1988**	**H414***	**35.0**	**1926**	**Re12**	**29.0**	**1853**
	27.0	1669		31.0	1599		25.0	1579
Viht. N140	**31.0**	**1983**	**IMR 4350**	**34.5**	**1915**	**H4350***	**34.0C**	**1771**
	27.0	1643		30.5	1570		30.0	1452
IMR 3031	**29.5**	**1975**	**IMR 4895**	**29.0**	**1879**			
	25.5	1699		25.0	1616			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

300 SAVAGE

This fine old cartridge dates to 1920 when Savage introduced it in its famous Model 99 lever-action rifle. Although a compact cartridge, the 300 Savage managed to deliver respectable velocities (for 1920) and was superior to the 30-30 Winchester in all respects.

Factory ammunition is loaded with 150 and 180 grain bullets. The handloader has much more flexibility because of the wide selection of 30 caliber component bullets. With Speer's 110 grain spitzer or the 125 grain TNT™ hollow point, the 300 Savage can be used on varmints out to 200 yards. Even the big Speer 200 grain spitzer can be used, although velocity is limited to around 2300 feet/sec which restricts shots to not more than 150 yards. For large deer and elk, the 180 grain Mag Tip is an excellent choice because this bullet expands well at the modest velocities achieved by the 300 Savage.

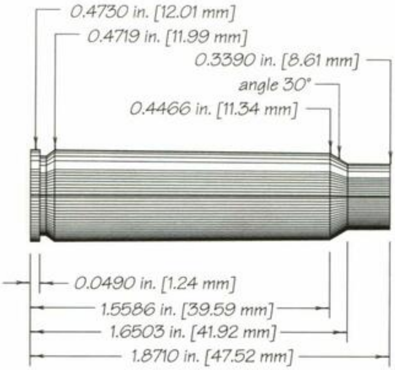
Accuracy of the 300 Savage is usually on par with any other 30 caliber sporting cartridge. However, its velocities aren't as high as many newer cartridges making long shots more difficult due to the arched trajectory. Even so, the 300 Savage is effective out to 200 yards on deer-sized game.

Bob Williams, RCBS Tool Line Machine Operator.

Reloading this cartridge is fairly straight-forward. Since most 300 Savage rifles are either lever- or slide-action, we recommend full length resizing after every shot. Some rifles may give better feeding if a small base sizing die (available from RCBS) is used. The unusually sharp 30° shoulder can cause sizing problems in the form of shoulder dents if too much lubricant is applied.

The case capacity of the 300 Savage is roughly the same as the 308 Winchester. However, the Savage is loaded to significantly lower pressures in deference to its use in lever guns, so it can't match the velocities of the newer cartridge. We found that two newer propellants, Reloder 15 and VihtaVuori N140, allowed up to 100 feet/sec velocity gain with heavier bullets compared to other powders.

These loads do not exceed the SAAMI maximum average pressure of 46,000 cup.


0.4730 in. [12.01 mm]
0.4719 in. [11.99 mm]
0.3390 in. [8.61 mm]
angle 30°
0.4466 in. [11.34 mm]
0.0490 in. [1.24 mm]
1.5586 in. [39.59 mm]
1.6503 in. [41.92 mm]
1.8710 in. [47.52 mm]

Max. Case Length: 1.871"
Trim-to Length: 1.861"
Max. Cart. Length: 2.600"
RCBS Shellholder: #3
Barrel Length: 20"
Twist: 1-12"

Test Firearm: Savage 99E
Case: FC
Primers: CCI 200, 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.475"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**48.0C**	**3096**	**IMR 4064**	**46.0C**	**3003**	**Viht. N130**	**40.0**	**2948**
	44.0	2826		42.0	2723		36.0	2690
Re7	**40.0**	**3061**	**IMR 3031**	**43.0C**	**3003**	**IMR 4320**	**45.0C**	**2847**
	36.0	2727		39.0	2711		41.0	2618
AA 2230*	**45.0**	**3007**	**IMR 4895**	**45.0C**	**2967**	Reduced Load **SR 4759**	**18.0C**	**1897**
	41.0	2705		41.0	2710		16.0	1675

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: Limit 110 HP velocities to 2900 fps maximum.

.308" Dia. **110 Grain** Sect. Density .166	**30** **HP**	**30** **RN-SP**	**30 Carb.** **RN-FMJ**	**30** **Spire-SP**		
Ballistic Coefficient	0.136	0.144	0.179	0.273		
C.O.L. Tested At	2.255"	2.330"	2.330"	2.475"		
Speer Part No.	1835	1845	1846	1855		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2230*	**45.0**	**3007**	**3031**	**42.0C**	**2874**	**Re7**	**38.0**	**2811**
	41.0	2709		31.0	2611		34.0	2497
H322	**44.0**	**2983**	**4064**	**45.0C**	**2849**	**H380***	**48.0C**	**2685**
	40.0	2824		41.0	2586		44.0	2451
Viht. N130	**40.0**	**2948**	**IMR 4895**	**44.0C**	**2833**	**IMR 4350**	**46.0C**	**2506**
	36.0	2674		40.0	2583		42.0	2272
748*	**47.0C**	**2941**	**IMR 4198**	**35.0**	**2820**	Reduced Load **SR 4759**	**19.0**	**1923**
	43.0	2684		31.0	2500		15.0	1531

.308" Dia. **125 Grain** Sect. Density .188	**30** **TNT-HP**					
Ballistic Coefficient	0.326					
C.O.L. Tested At	2.580"					
Speer Part No.	1986					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2460*	**44.0C**	**2906**	**BL-C(2)***	**40.0C**	**2810**	**IMR 4064**	**43.0C**	**2645**
	40.0	2586		36.0	2529		39.0	2407
Viht. N140	**46.0C**	**2868**	**748***	**47.0C**	**2786**	**H380***	**48.0C**	**2569**
	42.0	2567		43.0	2493		44.0	2286
Re12	**47.0C**	**2832**	**IMR 4320**	**45.0C**	**2759**	**H414***	**47.0C**	**2486**
	43.0	2506		41.0	2442		43.0	2237
IMR 4895	**44.0C**	**2813**	**IMR 3031**	**42.0C**	**2728**	**IMR 4350**	**45.0C**	**2398**
	40.0	2546		38.0	2496		41.0	2170

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. 130 Grain

Sect. Density 1.96

	30 HP	30 Flat-SP				
Ballistic Coefficient	0.265	0.248				
C.O.L. Tested At	2.520"	2.371"				
Speer Part No.	2005	2007				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**47.0C**	**2846**	**IMR 4064**	**43.0**	**2717**	**H380***	**47.0C**	**2597**
	43.0	2604		39.0	2458		43.0	2383
Viht. N140	**45.0C**	**2795**	**748***	**44.0**	**2688**	**IMR 4320**	**42.0**	**2506**
	41.0	2552		40.0	2430		38.0	2249
AA 2460*	**43.0**	**2794**	**IMR 4895**	**42.0**	**2660**	**IMR 4350**	**45.0C**	**2433**
	39.0	2525		38.0	2416		41.0	2226
H322	**42.0**	**2768**	**IMR 3031**	**40.0**	**2632**			
	38.0	2492		36.0	2379			

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.308" Dia. 150 Grain

Sect. Density .226

	30 Flat-SP	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP
Ballistic Coefficient	0.268	0.266	0.423	0.389	0.301	0.305
C.O.L. Tested At	2.375"	2.495"	2.550"	2.550"	2.540"	2.535"
Speer Part No.	2011	2017	2022	2023	2025	2026

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N140	**44.0C**	**2663**	**H322**	**40.0**	**2573**	**IMR 3031**	**38.5**	**2475**
	40.0	2405		36.0	2308		34.5	2228
Re12	**45.0C**	**2662**	**H380***	**46.0C**	**2513**	**IMR 4320**	**41.5**	**2445**
	41.0	2398		42.0	2289		37.5	2208
AA 2460*	**42.0**	**2660**	**IMR 4895**	**41.0**	**2506**	Reduced Load **SR 4759**	**21.0**	**1873**
	38.0	2415		37.0	2250		17.0	1523
IMR 4064	**41.5**	**2590**	**748***	**42.0**	**2488**			
	37.5	2334		38.0	2260			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **165 Grain** Sect. Density .248	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **GS-SP**		
Ballistic Coefficient	0.274	0.477	0.423	0.393		
C.O.L. Tested At	2.480"	2.550"	2.550"	2.540"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**44.0C**	**2614**	**H380***	**45.0C**	**2427**	**IMR 4350**	**45.0C**	**2381**
	40.0	2350		41.0	2220		41.0	2151
Viht. N140	**43.0C**	**2589**	**748***	**41.0**	**2421**	**IMR 4320**	**40.0**	**2342**
	39.0	2327		37.0	2192		36.0	2094
H322	**39.0**	**2469**	**IMR 4895**	**39.0**	**2398**	Reduced Load **SR 4759**	**21.0**	**1776**
	35.0	2205		35.0	2140		19.0	1597
IMR 4064	**40.0**	**2445**	**AA 2700***	**44.0C**	**2389**			
	36.0	2197		40.0	2176			

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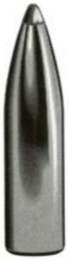
.308" Dia. **180 Grain** Sect. Density .271	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	2.480"	2.550"	2.550"	2.535"	2.535"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**43.0C**	**2469**	**760***	**44.5C**	**2353**	**IMR 4064**	**39.0**	**2315**
	39.0	2277		40.5	2124		35.0	2094
Viht. N140	**42.0C**	**2462**	**H380***	**44.0C**	**2347**	**AA 2700***	**42.0C**	**2243**
	38.0	2228		40.0	2128		38.0	2034
IMR 4350	**45.0C**	**2370**	**748***	**40.0**	**2331**	Reduced Load **IMR 4198**	**24.0**	**1742**
	41.0	2146		36.0	2089		22.0	1588
H414*	**45.0C**	**2369**	**IMR 4895**	**38.0**	**2326**			
	41.0	2136		34.0	2078			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.308" Dia. **200 Grain** Sect. Density .301	**30** **Spitz-SP**					
Ballistic Coefficient	0.556					
C.O.L. Tested At	2.550"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**42.0C**	**2379**	**IMR 4064**	**36.0**	**2137**	**AA 2700***	**40.0C**	**2104**
	38.0	2021		32.0	1899		36.0	1914
Viht. N140	**40.0C**	**2264**	**H380***	**41.0C**	**2128**	**IMR 4895**	**35.0**	**2092**
	36.0	1997		37.0	1900		31.0	1862
H414*	**45.0C**	**2249**	**760***	**41.0C**	**2128**	Reduced Load **IMR 4198**	**25.0**	**1848**
	41.0	2027		37.0	1916		23.0	1710
IMR 4350	**43.0C**	**2212**	**748***	**37.0**	**2123**			
	39.0	2010		33.0	1888			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

307 WINCHESTER

The popularity of the American lever-action rifle has led to numerous efforts to upgrade its performance. The most popular lever rifle ever built is the Winchester Model 94, but its original design limited the power of the cartridges which could be used.

U.S. Repeating Arms developed a stronger version of the Model 94 which could handle cartridge pressures up to 52,000 cup, much higher than the 30-30. The improved action featured thicker receiver walls and improved metallurgy. It also allowed top-mounting of scope sights by lowering the right sidewall and repositioning the extractor and ejector. This feature gave the new rifle its name—the Model 94 Angle Eject.

Two new cartridges were developed for the 94AE. The 307 and 356 Winchester have the same external dimensions as the 308 and 358 Winchester, respectively, with the exception of the rims. The new cartridges have the same rim diameter as the 30-30, making the cases semi-rimmed. Pressure levels for both newcomers were established at 52,000 cup.

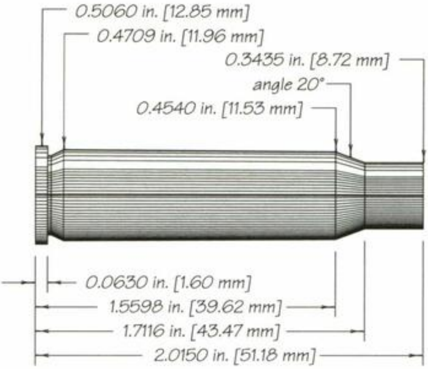
The walls of the 307 case are thicker than those of the 308 Winchester, reducing case capacity. WHEN LOADING THE 307 WINCHESTER, YOU MUST NOT USE 308 WINCHESTER DATA. FOLLOW PUBLISHED 307 LOADS TO THE LETTER.

The 307 is ballistically nearly equivalent to the 308 Winchester and can be used on the same type of game. Our test rifle gave impressive velocities considering that it has a 20 inch barrel. The only restriction is that flat point bullets MUST be used in tubular magazines for safety. This limits bullet selection. The 308 reloader can use bullets of various shapes up to 200 grains; the heaviest flat points suitable for the 307 are 170 grains.

In addition to Winchester, Marlin also produced 307 rifles. However, a check of catalogs as we went to press shows only Winchester still producing rifles for this cartridge.

Fans of traditional lever-action rifles who are seeking modern game performance would be hard-pressed to beat the 307 Winchester.

SAFETY REMINDER: USE ONLY FLAT POINT BULLETS WHEN LOADING CARTRIDGES FOR USE IN TUBULAR MAGAZINES. POINTED BULLETS COULD CAUSE A CARTRIDGE TO EXPLODE IN THE MAGAZINE WITH THE RISK OF PROPERTY DAMAGE AND/OR PERSONAL INJURY.


0.5060 in. [12.85 mm]
0.4709 in. [11.96 mm]
0.3435 in. [8.72 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0630 in. [1.60 mm]
1.5598 in. [39.62 mm]
1.7116 in. [43.47 mm]
2.0150 in. [51.18 mm]

Max. Case Length: 2.015"
Trim-to Length: 2.005"
Max. Cart. Length: 2.560"
RCBS Shellholder: #2
Barrel Length: 20"
Twist: 1-12"

Test Firearm: Winchester 94 AF
Case: W-W
Primers: CCI 200, 250

Note: We recommend that this bullet be loaded one at a time into the chamber.

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.390"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**37.0**	**2767**	**IMR 3031**	**40.0**	**2530**	**748***	**42.0**	**2441**
	33.0	2474		36.0	2149		38.0	2261
IMR 4320	**42.0**	**2630**	**2400**	**24.0**	**2511**	**H322**	**35.0**	**2419**
	38.0	2402		20.0	2180		31.0	2155
IMR 4198	**32.0**	**2600**	**IMR 4895**	**40.0**	**2474**			
	28.0	2380		36.0	2250			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.308" Dia.
110 Grain
Sect. Density .166

	30 HP					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.390"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**39.0**	**2795**	**IMR 4895**	**44.0C**	**2737**	**748***	**46.0**	**2683**
	35.0	2489		40.0	2544		42.0	2402
IMR 4198	**37.0**	**2788**	**IMR 3031**	**43.0**	**2701**	**2400**	**26.0**	**2531**
	33.0	2455		39.0	2223		22.0	2244
H322	**41.0**	**2785**	**IMR 4064**	**45.0**	**2685**			
	37.0	2183		41.0	2341			

.308" Dia.
130 Grain
Sect. Density .195

	30 Flat-SP					
Ballistic Coefficient	0.248					
C.O.L. Tested At	2.520"					
Speer Part No.	2007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**50.0C**	**2891**	**IMR 4895**	**45.0**	**2785**	**H322**	**40.0**	**2635**
	46.0	2650		41.0	2460		36.0	2210
748*	**49.0C**	**2849**	**IMR 3031**	**43.0C**	**2672**	**Re7**	**37.0**	**2566**
	45.0	2574		39.0	2301		33.0	2216
H335	**45.0**	**2802**	**IMR 4064**	**45.0C**	**2666**	**IMR 4320**	**43.0**	**2565**
	41.0	2562		41.0	2296		39.0	2204

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **150 Grain** Sect. Density .225	30 Flat-SP					
Ballistic Coefficient	0.268					
C.O.L. Tested At	2.520"					
Speer Part No.	2011					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**45.0**	**2603**	**H380***	**49.0C**	**2548**	**H335**	**41.0**	**2537**
	41.0	2452		45.0	2304		37.0	2353
IMR 3031	**41.0**	**2598**	**IMR 4895**	**42.0**	**2547**	**760***	**49.0C**	**2502**
	37.0	2313		38.0	2249		45.0	2241
IMR 4064	**44.0C**	**2566**	**H414***	**48.0**	**2542**	Reduced Load **H322**	**38.0**	**2392**
	40.0	2276		44.0	2248		34.0	2146

.308" Dia. **170 Grain** Sect. Density .257	30 Flat-SP					
Ballistic Coefficient	0.304					
C.O.L. Tested At	2.520"					
Speer Part No.	2041					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**45.0C**	**2455**	**H380***	**49.0C**	**2444**	**IMR 4320**	**41.0C**	**2378**
	41.0	2136		45.0	2169		37.0	2079
748*	**42.0**	**2446**	**IMR 4064**	**42.0C**	**2438**	**IMR 3031**	**40.0**	**2370**
	38.0	2189		38.0	2257		36.0	2102
BL-C(2)*	**43.0**	**2444**	**H335**	**39.0**	**2378**	**IMR 4895**	**40.0C**	**2357**
	39.0	2231		35.0	2114		36.0	2041

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

308 WINCHESTER

Like many other successful sporting cartridges, the 308 Winchester began as a military development. The search for an effective and compact cartridge for machine guns and semi-auto service rifles actually began shortly after World War I and continued until the experimental T65 cartridge was adopted by the U.S. as the 7.62 NATO service cartridge in 1954.

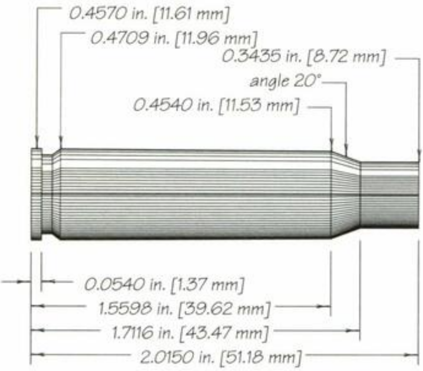
Winchester beat the military to the punch by introducing the T65 as the 308 Winchester in 1952. The case was almost a half-inch shorter than the 30-06 but, with special ball powders developed for the T65, the 308 could nearly match the ballistics of the older service cartridge. First offered in the Winchester Model 70 bolt action and the Model 88 lever action, the 308 was quickly picked up by other manufacturers. It was a natural for short-action rifles and quickly established a reputation for accuracy.

Winchester barrels for the 308 were made with a 1-in-12 inch twist rate. This limited the heaviest useful bullet weight to 200 grains instead of 220 grains found in the 30-06. Other rifle makers have built 308 rifles using 1-in-10 inch twist barrels. There seems to be little practical difference between the two twist rates with bullets lighter than 200 grains.

In the hunting field, ballistic differences between the 308 and the 30-06 are negligible. The choice between the two cartridges can often be made by the type of rifle action you prefer. A short bolt-action or a semi-auto, lever- or slide-action favors the 308. In full-length actions, the 30-06 gets the nod. Both cartridges can be used on similar types of game. They are suitable for anything in North America with the exception of the great bears. We prefer a larger, heavier bullet on these.

In a target-grade rifle, the 308 can be used effectively on steel and paper targets out to 1000 yards. Normally bullets such as Speer's 168 and 190 grain match boat tail hollow point are used for competition. In most rifles, the 308 is capable of top-notch accuracy.

Because the 308 Winchester is a military spin-off, surplus cases are readily available. Military cases are often thicker than commercial ones and have less case capacity. Reduce charges developed in commercial cases at least five percent when loading military brass. Also, try to match headstamps for more uniform results. These loads do not exceed the SAAMI maximum average pressure of 52,000 cup.



0.4570 in. [11.61 mm]
0.4709 in. [11.96 mm]
0.3435 in. [8.72 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0540 in. [1.37 mm]
1.5598 in. [39.62 mm]
1.7116 in. [43.47 mm]
2.0150 in. [51.18 mm]

Max. Case Length: 2.015"
Trim-to Length: 2.005"
Max. Cart. Length: 2.810"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-10"

Test Firearm: Remington 700
Case: IMI
Primers: CCI 200, 250, No. 34
Comments: The No. 34 Primers are the ballistic equivalent of the 250 Primers. They are recommended for military style semi-automatic rifles.

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.360"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2460*	**51.0C**	**3345**	**Viht. N120**	**39.0**	**3143**	**IMR 4064**	**49.0C**	**3061**
	47.0	3044		35.0	2829		45.0	2816
H322	**48.0**	**3261**	**H4895**	**48.0C**	**3112**	**Re7**	**41.0**	**3003**
	44.0	2968		44.0	2770		37.0	2703
Re12	**51.0C**	**3225**	**748***	**52.0C**	**3069**	Reduced Load **SR 4759**	**20.0**	**1941**
	47.0	2883		48.0	2823		16.0	1571

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: Velocities should be held to under 2900 fps with this bullet.

.308" Dia. 110 Grain Sect. Density .166	**30 HP**					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.405"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**43.0**	**2869**	**IMR 3031**	**42.5**	**2854**	**H322**	**41.0**	**2794**
	39.0	2612		38.5	2590		37.0	2495
IMR 4064	**45.5**	**2860**	**748***	**46.0**	**2849**	**Re7**	**37.0**	**2787**
	41.5	2614		42.0	2609		33.0	2456
H380*	**51.0C**	**2855**	**IMR 4198**	**36.0**	**2837**	**IMR 4227**	**29.0**	**2469**
	47.0	2639		32.0	2534		25.0	2121

.308" Dia. 110 Grain Sect. Density .166	**30 RN-SP**	**30 Carb. RN-FMJ**	**30 Spire-SP**			
Ballistic Coefficient	0.136	0.179	0.273			
C.O.L. Tested At	2.490"	2.490"	2.550"			
Speer Part No.	1845	1846	1855			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**50.0C**	**3218**	**IMR 3031**	**48.0C**	**3130**	**Viht. N120**	**38.0**	**3007**
	46.0	2832		44.0	2848		34.0	2676
Re12	**50.0C**	**3164**	**IMR 4895**	**48.5C**	**3123**	**IMR 4064**	**48.5C**	**3007**
	46.0	2816		44.5	2811		44.5	2676
H322	**46.0**	**3156**	**IMR 4320**	**51.0C**	**3068**	**760***	**51.0C**	**2687**
	42.0	2904		47.0	2823		47.0	2445
Re15	**51.0C**	**3144**	**H4895**	**47.0C**	**3019**	**H414***	**51.0C**	**2686**
	47.0	2830		43.0	2657		47.0	2417
AA 2520*	**49.0C**	**3143**	**748***	**51.0**	**3013**	Reduced Load **IMR 4198**	**30.0**	**2268**
	45.0	2860		47.0	2651		26.0	1927

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

125 Grain
130 Grain

.308" Dia. 125 Grain 130 Grain	**30 TNT-HP**	**30 HP**				
Sectional Density	0.188	0.196				
Ballistic Coefficient	0.257	0.263				
C.O.L. Tested At	2.635"	2.615"				
Speer Part No.	1986	2005				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**50.0C**	**3062**	**748***	**50.0C**	**2963**	**IMR 4064**	**48.0C**	**2903**
	46.0	2756		46.0	2726		44.0	2613
AA 2460*	**48.0C**	**3061**	**AA 2520***	**48.0C**	**2947**	**IMR 3031**	**45.0C**	**2902**
	44.0	2694		44.0	2682		41.0	2670
Re12	**49.0C**	**3052**	**H322**	**44.0**	**2931**	**760***	**50.0C**	**2710**
	45.0	2716		40.0	2638		46.0	2493
IMR 4320	**50.0C**	**2992**	**Viht. N135**	**46.0C**	**2922**	**H414***	**50.0C**	**2688**
	46.0	2663		42.0	2630		46.0	2446
AA 2230*	**46.0C**	**2982**	**IMR 4895**	**46.0C**	**2916**	Reduced Load **IMR 4198**	**29.0**	**2185**
	42.0	2624		42.0	2654		25.0	1969

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.308" Dia. **150 Grain** Sect. Density .226	**30** **RN-SP**	**30 BT** **FMJ**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**
Ballistic Coefficient	0.266	0.425	0.423	0.389	0.301	0.305
C.O.L. Tested At	2.490"	2.800"	2.700"	2.700"	2.685"	2.680"
Speer Part No.	2017	2018	2022	2023	2025	2026

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzi.Vel.
Re15	**49.0C**	**2919**	**IMR 4064**	**47.0**	**2814**	**BL-C(2)***	**44.0**	**2607**
	45.0	2683		43.0	2533		40.0	2372
AA 2520*	**48.0C**	**2915**	**IMR 4320**	**48.0C**	**2795**	**760***	**50.0C**	**2599**
	44.0	2565		44.0	2488		46.0	2339
H335*	**47.0**	**2879**	**IMR 4895**	**45.0**	**2776**	**H380***	**49.0C**	**2578**
	43.0	2562		41.0	2554		45.0	2346
748*	**50.0C**	**2868**	**IMR 3031**	**44.0**	**2762**	**H4350**	**49.0C**	**2506**
	46.0	2653		39.0	2434		45.0	2235
Viht. N135	**46.0C**	**2822**	**H414***	**51.0**	**2642**	Reduced Load **SR 4759**	**25.0**	**1925**
	42.0	2605		47.0	2325		21.0	1632

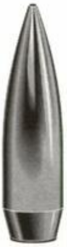
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **165 Grain** Sect. Density .248	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **GS-SP**		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	2.575"	2.800"	2.800"	2.685"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**47.0C**	**2812**	**IMR 3031**	**43.0**	**2725**	**Re12**	**44.0**	**2656**
	43.0	2587		39.0	2482		40.0	2364
AA 2520*	**45.0C**	**2748**	**748***	**46.0**	**2713**	**IMR 4350**	**49.0C**	**2571**
	41.0	2501		42.0	2469		45.0	2314
Viht. N140	**46.0C**	**2744**	**H414***	**51.0C**	**2699**	**BL-C(2)***	**42.0**	**2550**
	42.0	2524		47.0	2402		38.0	2295
AA 2460*	**44.0**	**2738**	**760***	**51.0C**	**2679**	**H380***	**49.0C**	**2529**
	40.0	2464		47.0	2358		45.0	2251
IMR 4064	**45.0**	**2727**	**IMR 4895**	**43.0C**	**2673**	Reduced Load **SR 4759**	**24.0**	**1805**
	41.0	2482		39.0	2352		22.0	1639

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Dee Florence finds that they don't always fall like the pictures show in those hunting magazines.



¤ = Recommended for gas-operated semi-automatic match rifles.

.308" Dia. **168 Grain** Sect. Density .253	**30 BT** **HP-Match**					
Ballistic Coefficient	0.480					
C.O.L. Tested At	2.800"					
Speer Part No.	2040					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N150	**47.0C**	**2739**	**AA 2460*** ¤	**44.0**	**2692**	**760***	**49.0**	**2629**
	43.0	2410		40.0	2369		45.0	2418
IMR 4064 ¤	**46.0**	**2724**	**AA 2520*** ¤	**44.0**	**2660**	**Re12** ¤	**44.0**	**2627**
	42.0	2479		40.0	2447		40.0	2312
748* ¤	**46.0**	**2720**	**IMR 4895** ¤	**44.0**	**2656**	**BL-C(2)*** ¤	**45.0**	**2625**
	42.0	2448		40.0	2390		41.0	2336
Re15 ¤	**45.0**	**2710**	**IMR 3031** ¤	**43.0**	**2654**	**H380***	**49.0C**	**2556**
	41.0	2412		39.0	2442		45.0	2275
IMR 4320 ¤	**46.0**	**2700**	**H414***	**49.0**	**2634**	**IMR 4350**	**49.0C**	**2443**
	42.0	2457		45.0	2318		45.0	2174

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Connie Snider, CCI/Speer employee inpects .308 caliber 125 gr. TNT bullets before packaging.

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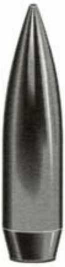
.308" Dia. **180 Grain** Sect. Density .271	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	2.580"	2.800"	2.800"	2.680"	2.680"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**45.0C**	**2613**	**760***	**48.0C**	**2501**	**H380***	**48.0C**	**2440**
	41.0	2299		44.0	2301		44.0	2147
AA 2460*	**43.0**	**2603**	**H414***	**48.0C**	**2484**	**IMR 4895**	**41.0**	**2418**
	39.0	2317		44.0	2186		37.0	2176
Viht. N150	**45.0C**	**2573**	**IMR 4320**	**44.0**	**2479**	**IMR 4350**	**48.0**	**2414**
	41.0	2316		40.0	2256		44.0	2148
748*	**45.0**	**2553**	**H335***	**42.0**	**2475**	**H4350**	**47.0C**	**2331**
	41.0	2298		38.0	2277		43.0	2075
IMR 4064	**43.0C**	**2521**	**AA 2520***	**41.0**	**2451**	Reduced Load **IMR 4198**	**28.0**	**1854**
	39.0	2294		37.0	2255		24.0	1591

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



¤ = Recommended for gas-operated semi-automatic match rifles.

.308" Dia. **190 Grain** Sect. Density .286	**30 BT HP-Match**					
Ballistic Coefficient	0.540					
C.O.L. Tested At	2.800"					
Speer Part No.	2080					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**44.0C**	**2561**	**Viht. N150**	**44.0**	**2512**	**IMR 4350**	**48.0C**	**2477**
	¤ 40.0	2254		¤ 40.0	2261		44.0	2229
H414*	**48.0C**	**2541**	**IMR 4320**	**43.0C**	**2499**	**H380***	**48.0C**	**2441**
	44.0	2261		39.0	2224		44.0	2197
AA 2460*	**42.0**	**2540**	**748***	**43.0**	**2496**	**AA 2495**	**41.0C**	**2429**
	¤ 38.0	2311		¤ 39.0	2271		¤ 37.0	2138
IMR 4064	**43.0C**	**2532**	**H4895**	**41.0C**	**2488**	**AA 2520***	**40.0**	**2406**
	¤ 39.0	2318		¤ 37.0	2214		¤ 36.0	2189
760*	**48.0C**	**2522**	**IMR 3031**	**41.0C**	**2481**	**IMR 4895**	**39.0**	**2347**
	44.0	2219		¤ 37.0	2213		¤ 35.0	2159

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

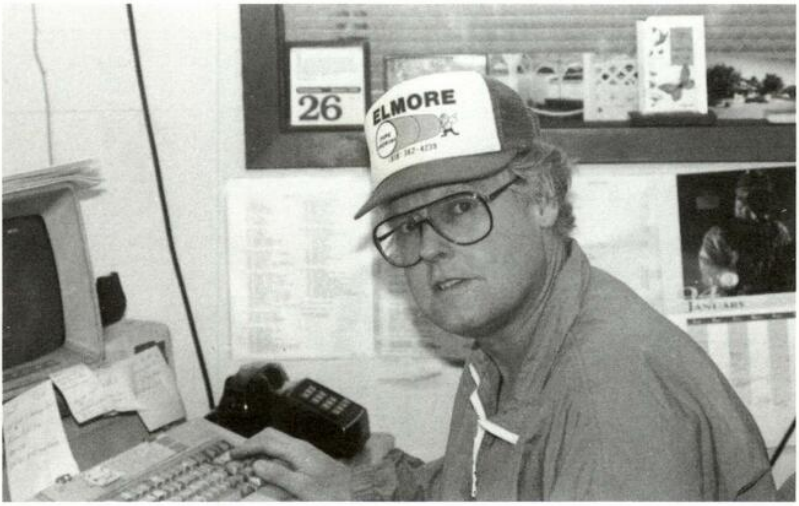
.308" Dia. 200 Grain

Sect. Density .301

	30 Spitz-SP					
Ballistic Coefficient	0.556					
C.O.L. Tested At	2.800"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**42.0**	**2416**	**IMR 4350**	**47.0C**	**2374**	**Viht. N140**	**41.0**	**2352**
	38.0	2126		43.0	2113		37.0	2093
748*	**43.0**	**2416**	**IMR 4320**	**42.0**	**2369**	**AA 2520***	**40.0**	**2344**
	39.0	2223		38.0	2156		36.0	2156
AA 2460*	**40.5**	**2415**	**IMR 4895**	**40.0**	**2366**	**IMR 4064**	**40.5**	**2327**
	36.5	2199		36.0	2082		36.5	2048
H414*	**46.0C**	**2414**	**H380***	**47.0C**	**2363**	**H4350**	**46.0C**	**2283**
	42.0	2124		43.0	2127		42.0	2032
760*	**48.0C**	**2390**	**IMR 4831**	**47.0C**	**2361**	Reduced Load **IMR 4198**	**28.0C**	**1757**
	44.0	2199		43.0	2125		24.0	1514

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Darrell Huston, RCBS Tool Crib/Safety Technician.

30-40 KRAG

The 30-40 Krag was the U.S. Army's first small-bore service rifle cartridge. Adopted in 1892 to replace the 45-70, the new cartridge propelled a 220 grain full jacket, round nose bullet at a velocity of around 2200 feet/sec. The new service rifle was built on a bolt-action designed by Captain Ole H.J. Krag of Norway. Even though the new rifle was officially denoted as the U.S. Magazine Rifle Model 1892, most people simply called it the Krag.

This somewhat odd-looking rifle proved to be reliable and has a reputation even today as one of the smoothest bolt actions around. Although not a particularly strong action, it was perfectly suited for the modest pressures of the 30-40 cartridge. It served its country well and, when the rifles were declared surplus, many fine Krags found civilian homes. The Director of Civilian Marksmanship (DCM) sold many Krag rifles and carbines along with low-cost reloading components.

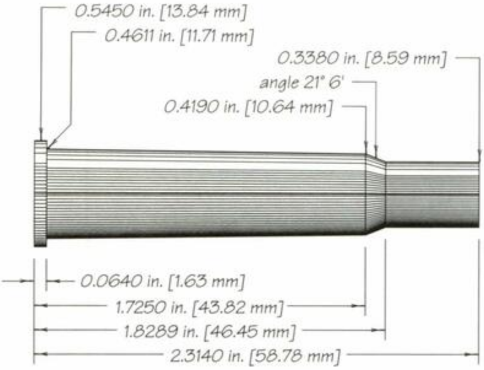
The Krag proved quite successful as a hunting cartridge. Commercial ammunition was loaded with a 220 grain soft point bullet which gave deep penetration on large game. With heavy bullets, the Krag can take elk and moose although it is underpowered for the large bears. Loaded with a modern 180 grain soft point bullet (such as the Speer Hot-Cor), the Krag is an excellent deer cartridge out to 250 yards.

Most military Krag chambers have a generous throat to accommodate the long service bullet. Because of this, most Krag shooters have found that bullets lighter than 180 grains may not be as accurate as heavier ones. Also, many Krag rifles have trouble feeding spitzer bullets. However, they function fine with round nose designs.

Although the nominal groove diameter of the military Krag barrel is 0.308", manufacturing technology in the 1890's wasn't up to today's standards. Thus it isn't uncommon to encounter Krags with odd groove diameters. The editor found one near-mint Krag rifle with a groove diameter of 0.314". Our best advice is to determine the groove diameter by slugging (see Chapter 8). If the bore is oversized (say .311" or .312") best accuracy will be obtained by using .311" bullets intended for the 303 British (you'll need a 0.310" expander button). If over .312", the rifle probably won't shoot anything well with the exception of certain cast bullets. However, a Krag with a 0.308" barrel in nice shape can produce excellent groups today— over a hundred years after its birth!

Although the Krag cartridge is best known in the rifle of the same name, it was also chambered in Winchester's Model 1895 lever rifle and Model 1885 single-shot (the "High Wall"). Remington also chambered rifles for the 30-40. In the 1970's Ruger produced a short run of its #3 single-shot carbines for this cartridge.

The SAAMI maximum average pressure for the 30-40 Krag cartridge is 40,000 cup. These loads do not exceed that limit.


0.5450 in. [13.84 mm]
0.4611 in. [11.71 mm]
0.3380 in. [8.59 mm]
angle 21° 6'
0.4190 in. [10.64 mm]
0.0640 in. [1.63 mm]
1.7250 in. [43.82 mm]
1.8289 in. [46.45 mm]
2.3140 in. [58.78 mm]

Max. Case Length: 2.314"
Trim-to Length: 2.304"
Max. Cart. Length: 3.089"
RCBS Shellholder: #7
Barrel Length: 21"
Twist: 1-10"

Test Firearm: U.S. Krag Model 1898
Case: W-W
Primers: CCI 200, 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.610"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**45.0**	**3070**	**H380***	**51.0**	**2820**	**IMR 4350**	**53.0**	**2634**
	41.0	2743		47.0	2608		49.0	2429
IMR 4320	**48.0**	**2952**	**IMR 4064**	**46.0**	**2811**	Reduced Load **SR 4759**	**20.0**	**1941**
	44.0	2715		42.0	2551		16.0	1571
IMR 3031	**44.0**	**2829**	**IMR 4895**	**44.0**	**2732**			
	40.0	2562		40.0	2473			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Note: This bullet not recommended for velocities over 2900 fps.

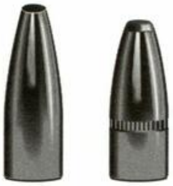
.308" Dia. **110 Grain** Sect. Density .166	**30** **HP**					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.760"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4320	**47.0**	**2817**	**IMR 4064**	**45.0**	**2667**	**IMR 4350**	**52.0**	**2538**
	43.0	2569		41.0	2413		48.0	2329
IMR 3031	**43.0**	**2732**	**IMR 4895**	**43.0**	**2625**	Reduced Load **IMR 4198**	**30.0**	**2268**
	39.0	2471		39.0	2378		26.0	1965
H380*	**50.0**	**2710**	**H322**	**42.0**	**2611**			
	46.0	2505		38.0	2315			

.308" Dia. **110 Grain** Sect. Density .166	**30** **Spire-SP**	**30** **RN-SP**				
Ballistic Coefficient	0.273	0.144				
C.O.L. Tested At	2.760"	2.760"				
Speer Part No.	1855	1845				

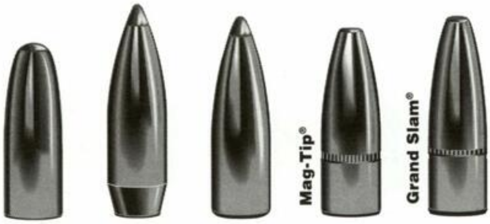
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4320	**48.0**	**2971**	**IMR 4064**	**46.0**	**2843**	**H322**	**42.0**	**2611**
	44.0	2735		42.0	2599		38.0	2336
IMR 3031	**44.0**	**2860**	**IMR 4895**	**44.0**	**2754**	Reduced Load **IMR 4198**	**30.0**	**2268**
	40.0	2607		40.0	2509		26.0	1927
H380*	**51.0**	**2846**	**IMR 4350**	**53.0**	**2655**			
	47.0	2638		49.0	2463			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.308" Dia. 130 Grain Sect. Density .195	30 HP	30 Flat-SP				
Ballistic Coefficient	0.263	0.248				
C.O.L. Tested At	2.865"	2.865"				
Speer Part No.	2005	2007				

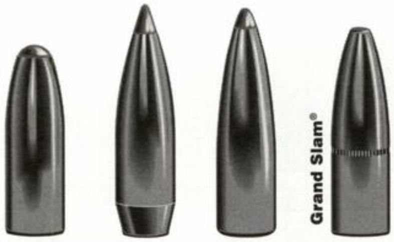
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**46.0**	**2647**	IMR 3031	**43.0**	**2568**	H322	**37.0**	**2227**
	42.0	2404		39.0	2303		33.0	1988
IMR 4320	**46.0**	**2588**	H414*	**51.0**	**2541**	IMR 4198	**29.0**	**2185**
	42.0	2353		47.0	2298		25.0	1969
H380*	**48.0**	**2579**	IMR 4350	**52.0**	**2530**			
	44.0	2373		48.0	2329			



.308" Dia. 150 Grain Sect. Density .225	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP	
Ballistic Coefficient	0.266	0.423	0.389	0.301	0.305	
C.O.L. Tested At	3.059"	3.089"	3.089"	3.089"	3.089"	
Speer Part No.	2017	2022	2023	2025	2026	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**50.0**	**2457**	H380*	**47.0**	**2444**	H322	**35.0**	**2151**
	46.0	2211		43.0	2196		31.0	1876
IMR 3031	**41.0**	**2454**	H414*	**49.0**	**2383**	Reduced Load SR 4759	**25.0**	**1925**
	37.0	2210		45.0	2147		21.0	1632
IMR 4064	**42.0**	**2452**	IMR 4895	**39.0**	**2326**			
	38.0	2204		35.0	2046			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

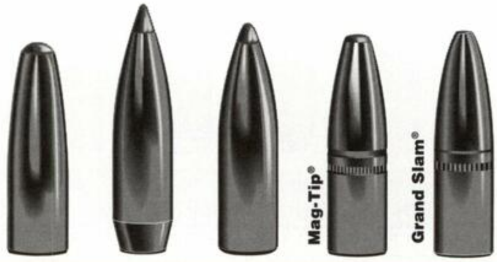


.308" Dia. 165 Grain

Sect. Density .247

	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 GS-SP		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	3.089"	3.089"	3.089"	3.089"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**41.0**	**2309**	**H414***	**47.0**	**2252**	**H322**	**34.0**	**2080**
	37.0	2079		43.0	2028		30.0	1811
IMR 4831	**48.0**	**2283**	**IMR 4350**	**48.0**	**2232**	**IMR 4759**	**24.0**	**1805**
	44.0	2096		44.0	2040		22.0	1639
H380*	**44.0**	**2252**	**IMR 4895**	**38.0**	**2218**			
	40.0	2016		34.0	1934			



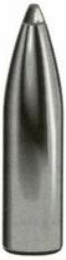
.308" Dia. 180 Grain

Sect. Density .270

	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP	
Ballistic Coefficient	0.304	0.483	0.500	0.352	0.416	
C.O.L. Tested At	3.089"	3.089"	3.089"	3.089"	3.089"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**47.0**	**2162**	**760***	**45.0**	**2122**	**H414***	**43.0**	**2034**
	43.0	1983		41.0	1903		39.0	1847
IMR 4350	**46.0**	**2125**	**IMR 4064**	**38.0**	**2112**	Reduced Load **IMR 4198**	**28.0**	**1854**
	42.0	1947		34.0	1863		24.0	1591
IMR 4895	**37.0**	**2125**	**IMR 3031**	**37.0**	**2118**			
	33.0	1833		33.0	1867			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.308" Dia. **200 Grain** Sect. Density .301	**30** **Spitz-SP**					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.089"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**44.0**	**2018**	**IMR 3031**	**35.0**	**1961**	**H414***	**40.0**	**1841**
	42.0	1915		31.0	1712		38.0	1738
IMR 4831	**45.0**	**2002**	**IMR 4064**	**37.0**	**1941**	Reduced Load **IMR 4198**	**28.0**	**1757**
	43.0	1898		35.0	1829		24.0	1514
IMR 4895	**36.0**	**1963**	**760***	**42.0**	**1930**			
	34.0	1849		38.0	1711			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

30-06 SPRINGFIELD

It is safe to say that the 30-06 is the best-known and most successful centerfire cartridge ever developed. It served its country well in three wars, accounted for countless head of game all over the world and still holds many target shooting records.

The U.S. military adopted its first rimless 30 caliber service cartridge in 1903 in the famous M1903 Springfield service rifle. Ballistically, the cartridge was similar to the 30-40 Krag using the same 220 grain bullet at a slightly higher velocity. In 1906, the cartridge was changed to incorporate a lighter, spitzer bullet at higher velocity. Case dimensions were also changed slightly and the new version was called the "Ball Cartridge, Caliber 30, Model of 1906". Fortunately, this rather lengthy name was shortened to 30-06 for commercial use.

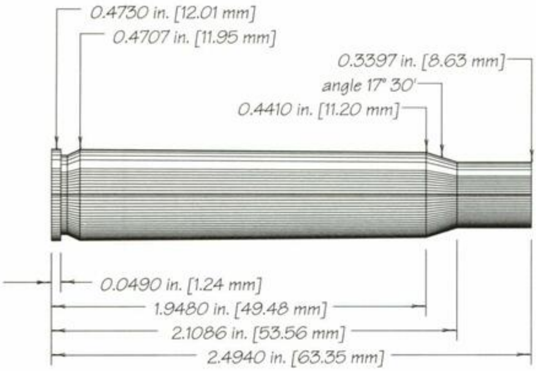
Almost every U.S. military service cartridge has been a commercial success, and the 30-06 is no exception. Hunters found that its power, quite impressive for the time, made the 30-06 a versatile game cartridge. It has been used on every species of North American game and has also proved effective on African plains animals.

Factory ammunition is loaded with a wide range of bullet weights from 125 grain soft points for varmints to the long, 220 grain bullets for large game. The most popular weights for big game fall between 150 and 180 grains. Although somewhat underpowered for the great bears, the 30-06 has been used on them anyway (with varying degrees of success!). Normally, bullets weighing 200 to 220 grains would be chosen for bear, although we strongly encourage using larger bores and heavier bullets for big and dangerous bruins.

The 30-06 with the Speer 165 grain flat base or boat tail bullet is a flat-shooting cartridge for most western hunting. The same cartridge loaded with a 165 or 180 grain round nose is quite at home in dense eastern woods. Load the 125 grain TNT and you're ready for long shots on varmints. For formal target shooting, the Speer 168 or 190 grain match hollow points will print tight groups at long ranges. Are you teaching a youngster how to shoot a centerfire rifle? Load the 100 grain Speer Plinker at 2000 feet/sec and you have a light-recoil training round. Larger cases make loading accurate reduced loads difficult. The 30-06 case seems to be about the largest 30 caliber case which still allows loading efficient reduced loads.

For the North American hunter who wants one rifle to use on a wide variety of game, the 30-06 is still hard to beat. Velocities are only 200 to 400 feet/sec behind the 30 caliber magnums and the 30-06 uses much less powder and kicks less. Thus, nearly ninety years after its introduction, the 30-06 remains one of the most effective and flexible cartridges on the shooting scene.

The following data do not exceed the SAAMI maximum average pressure of 50,000 cup.


0.4730 in. [12.01 mm]
0.4707 in. [11.95 mm]
0.3397 in. [8.63 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.1086 in. [53.56 mm]
2.4940 in. [63.35 mm]

Max. Case Length: 2.494"
Trim-to Length: 2.484"
Max. Cart. Length: 3.340"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-10"

Test Firearm: Remington Model 700
Case: W-W
Primers: CCI 200, 250, No. 34
Comments: The No. 34 Primers are the ballistic equivalent of the 250 Primers. They are recommended for military style semi-automatic rifles.

.308" Dia. 100 Grain Sect. Density .151	**30 RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.935"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**57.0**	**3448**	**748**	**60.0**	**3313**	**H322**	**52.0**	**3216**
	53.0	3199		56.0	3117		48.0	2943
IMR 4064	**59.0**	**3390**	**IMR 4895**	**55.0**	**3268**	**Re7**	**47.0**	**3188**
	55.0	3152		51.0	3028		43.0	2837
H335	**58.0**	**3326**	**IMR 4320**	**58.0**	**3236**	Reduced Load **SR 4759**	**20.0**	**1960**
	54.0	3099		54.0	3000		16.0	1548

Notes: Bold print denotes maximum loads. They should be used with caution.

Note: Hold velocities
to under 2900 fps.

.308" Dia. **110 Grain** Sect. Density .166	**30** **HP**					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.870"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**56.0**	**2865**	**IMR 3031**	**46.5**	**2833**	**H322**	**45.0**	**2735**
	52.0	2651		42.5	2572		41.0	2504
748*	**48.5**	**2850**	**IMR 4895**	**48.0**	**2810**	**BL-C(2)***	**52.0**	**2732**
	44.5	2601		44.0	2560		48.0	2511
IMR 4350	**58.0**	**2835**	**Re7**	**42.0**	**2799**	**IMR 4227**	**31.0**	**2475**
	54.0	2621		38.0	2514		29.0	2297

.308" Dia. **110 Grain** Sect. Density .166	**30** **RN-SP**	**30** **FMJ**	**30** **Spire-SP**			
Ballistic Coefficient	0.144	0.179	0.273			
C.O.L. Tested At	2.915	2.915"	3.000"			
Speer Part No.	1845	1846	1855			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**62.0C**	**3356**	**IMR 4064**	**58.0**	**3212**	**H4895**	**53.0**	**3076**
	58.0	3151		54.0	2924		49.0	2818
Re15	**60.0C**	**3307**	**Viht. N135**	**55.0**	**3206**	**BL-C(2)***	**55.0**	**3050**
	56.0	3077		51.0	3003		51.0	2779
AA 2460*	**55.0**	**3293**	**AA 2495**	**55.0**	**3167**	**H335***	**54.0**	**3027**
	51.0	3082		51.0	2909		50.0	2735
AA 2520*	**56.0**	**3288**	**IMR 4320**	**57.0**	**3088**	**H322**	**50.0**	**2901**
	52.0	3096		53.0	2891		46.0	2754
Re12	**56.0**	**3214**	**IMR 4895**	**54.5**	**3080**	Reduced Load **SR 4759**	**21.0**	**1980**
	52.0	2975		50.5	2869		17.0	1590

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

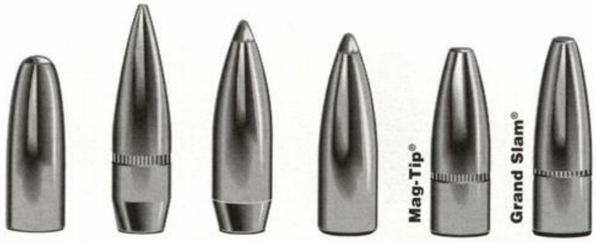
.308" Dia. **125 Grain** Sect. Density .188	**30** **TNT-HP**					
Ballistic Coefficient	0.326					
C.O.L. Tested At	3.100"					
Speer Part No.	1986					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**53.0**	**3129**	**AA 2495**	**54.0**	**3059**	**Re12**	**54.0**	**2979**
	49.0	2932		50.0	2838		50.0	2784
IMR 3031	**54.0**	**3118**	**AA 2230**	**51.0**	**3057**	**IMR 4320**	**55.0**	**2968**
	50.0	2824		47.0	2849		51.0	2728
Viht. N135	**53.0**	**3069**	**H335**	**55.0**	**3047**	**IMR 4895**	**52.0**	**2959**
	49.0	2807		51.0	2834		48.0	2742
AA 2015BR	**50.0**	**3064**	**AA 2520***	**52.0**	**3039**	**H322**	**48.0**	**2877**
	46.0	2866		48.0	2829		44.0	2687
BL-C(2)*	**55.0**	**3060**	**H4895**	**51.0**	**2982**			
	51.0	2836		47.0	2708			

.308" Dia. **130 Grain** Sect. Density .196	**30** **HP**	**30** **Flat-SP**				
Ballistic Coefficient	0.263	0.248				
C.O.L. Tested At	3.060"	3.045"				
Speer Part No.	2005	2007				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2460*	**51.0**	**2987**	**AA 2495**	**53.0**	**2941**	**BL-C(2)***	**53.0**	**2855**
	47.0	2769		49.0	2744		49.0	2667
IMR 4064	**55.0**	**2979**	**H335***	**54.0**	**2937**	**Viht. N140**	**52.0**	**2830**
	51.0	2767		50.0	2724		48.0	2640
H414*	**60.0**	**2969**	**IMR 4895**	**51.5**	**2897**	**IMR 4320**	**53.0**	**2737**
	56.0	2752		47.5	2695		49.0	2516
AA 2015BR	**49.0**	**2961**	**748***	**55.0**	**2871**	**H4895**	**49.0**	**2730**
	45.0	2768		51.0	2695		45.0	2624
IMR 3031	**52.5**	**2960**	**Re12**	**52.0**	**2864**	**H322**	**47.0**	**2723**
	48.5	2647		48.0	2666		43.0	2519

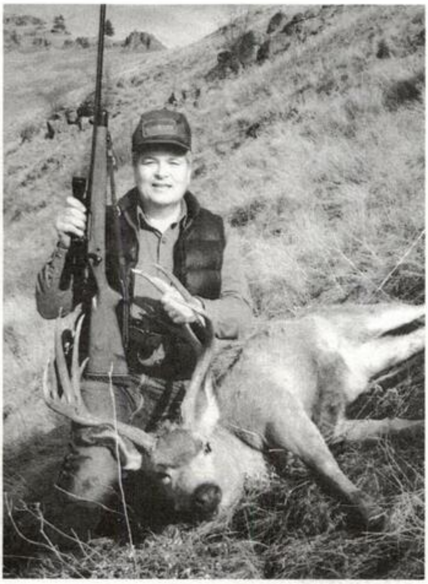
Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



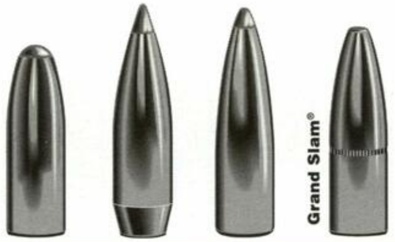
.308" Dia. **150 Grain** Sect. Density .226	**30** **RN-SP**	**30 BT** **FMJ**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**
Ballistic Coefficient	0.266	0.425	0.423	0.389	0.301	0.305
C.O.L. Tested At	3.130"	3.295"	3.250"	3.250"	3.165"	3.160"
Speer Part No.	2017	2018	2022	2023	2025	2026

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**58.0**	**2847**	**Viht. N140**	**51.0**	**2738**	**AA 2495**	**49.0**	**2716**
	54.0	2658		47.0	2548		45.0	2532
IMR 4350	**59.0**	**2834**	**IMR 3031**	**49.5**	**2735**	**IMR 4320**	**52.0**	**2700**
	55.0	2591		45.5	2551		48.0	2480
H414*	**58.0**	**2803**	**Re15**	**52.0**	**2728**	**AA 2520***	**47.0**	**2657**
	54.0	2603		48.0	2523		43.0	2488
760*	**57.0**	**2778**	**IMR 4895**	**49.5**	**2722**	**H4895**	**46.0**	**2572**
	53.0	2531		45.5	2516		42.0	2427
H4350	**59.0C**	**2765**	**Viht. N135**	**49.0**	**2720**	Reduced Load **SR 4759**	**24.0**	**1957**
	55.0	2514		45.0	2529		20.0	1620

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Ken Alexander, CCI/Speer Development Engineer (30-06, 165 gr. Hot-Cor)



.308" Dia. 165 Grain Sect. Density .248	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 GS-SP		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	3.130"	3.250"	3.250"	3.165"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**57.0**	**2803**	**H380***	**55.0**	**2707**	**AA 2495**	**48.0**	**2628**
	53.0	2601		51.0	2517		44.0	2386
IMR 4350	**58.0**	**2747**	**IMR 4831**	**59.0**	**2670**	**Re19**	**59.0C**	**2614**
	54.0	2476		55.0	2419		55.0	2351
Re22	**62.0C**	**2725**	**Viht. N140**	**50.0**	**2663**	**AA 2520***	**46.0**	**2595**
	58.0	2504		46.0	2465		42.0	2333
H4350	**58.0C**	**2724**	**IMR 4064**	**50.5**	**2640**	**H4895**	**44.0**	**2464**
	54.0	2464		46.5	2410		40.0	2272
H414*	**56.0**	**2723**	**H4831**	**61.0C**	**2632**	Reduced Load **SR 4759**	**25.0**	**1941**
	52.0	2494		57.0	2387		21.0	1616

¤ = Recommended for gas-operated semi-automatic match rifles.

.308" Dia. 168 Grain Sect. Density .253	30 BT HP-Match					
Ballistic Coefficient	0.480					
C.O.L. Tested At	3.295"					
Speer Part No.	2040					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**61.0**	**2825**	**IMR 7828***	**62.0C**	**2706**	**H414***	**54.0**	**2633**
	57.0	2581		58.0	2547		50.0	2429
H4350	**60.0C**	**2795**	**Re19**	**61.0C**	**2697**	**760***	**54.0**	**2628**
	56.0	2563		57.0	2464		50.0	2389
IMR 4350	**59.0**	**2782**	**H4831***	**61.0C**	**2661**	**IMR 4895** ¤	**48.0**	**2605**
	55.0	2558		57.0	2426		44.0	2437
H380* ¤	**55.0**	**2736**	**IMR 4831***	**60.0**	**2633**	**IMR 4064** ¤	**49.0**	**2549**
	51.0	2454		56.0	2376		45.0	2367

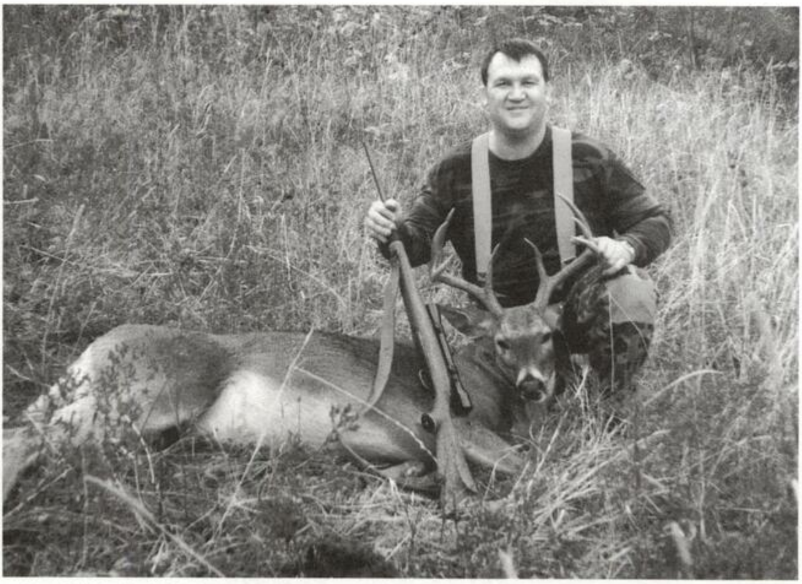
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Mag-Tip®
Grand Slam®

.308" Dia. **180 Grain** Sect. Density .271	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	3.130"	3.250"	3.160"	3.160"	3.160"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**58.0C**	**2756**	**H414**	**55.0**	**2673**	**H380***	**52.0**	**2545**
	54.0	2640		51.0	2545		48.0	2453
IMR 4064	**50.0**	**2756**	**Re19**	**59.0C**	**2640**	**AA 2520***	**45.0**	**2544**
	46.0	2583		55.0	2458		41.0	2355
Re22	**62.0C**	**2721**	**IMR 4350**	**56.0C**	**2639**	**IMR 4895**	**47.0**	**2537**
	58.0	2618		52.0	2497		43.0	2365
IMR 4831	**59.0C**	**2684**	**H4831***	**61.0C**	**2634**	**IMR 3031**	**46.0**	**2476**
	55.0	2544		57.0	2524		42.0	2276
760*	**55.0**	**2677**	**Viht. N160**	**56.0**	**2556**	Reduced Load **IMR 4198**	**30.0**	**2000**
	51.0	2540		52.0	2331		26.0	1723

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Ron Zielinski, CCI/Speer Hot-Swage Machine set-up, with a fine whitetail. And, take note on the next page of wife Deanna's deer... (.30-06, 165 gr. Grand Slam)

¤ = Recommended for gas-operated semi-automatic match rifles.

.308" Dia. **190 Grain** Sect. Density .286	**30 BT HP-Match**					
Ballistic Coefficient	0.540					
C.O.L. Tested At	3.295"					
Speer Part No.	2080					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**56.0**	**2621**	**IMR 4064**	**48.0**	**2552**	**AA 3100**	**57.0**	**2482**
	52.0	2356		¤ 44.0	2263		53.0	2240
IMR 7828	**61.0C**	**2614**	**IMR 4831**	**56.0**	**2551**	**760***	**51.0**	**2423**
	57.0	2381		52.0	2254		47.0	2234
Viht. N160	**57.0**	**2601**	**H4831***	**59.0C**	**2538**	**H380***	**50.0**	**2417**
	53.0	2380		55.0	2317		¤ 46.0	2144
Re19	**59.0**	**2596**	**H1000**	**63.0C**	**2497**	**H414***	**51.0**	**2410**
	55.0	2376		59.0	2268		47.0	2216
IMR 4350	**55.0**	**2580**	**AA 2520***	**46.0**	**2492**	**Re15**	**46.0**	**2397**
	51.0	2330		¤ 42.0	2316		¤ 42.0	2208

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Deanna Zielinski, CCI/Speer Header Operator, with her whitetail. Deanna and Ron exemplify the shooting sports' family experiences. (.30-30 caliber, 150 gr. flat nose)

.308" Dia. **200 Grain** Sect. Density .114	**30** **Spitz-SP**					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.295"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**57.0C**	**2554**	**IMR 4831**	**56.0C**	**2429**	**760***	**51.0**	**2348**
	53.0	2337		52.0	2283		47.0	2240
Re22*	**58.0C**	**2499**	**Viht. N160**	**54.0**	**2386**	**Re19**	**55.0**	**2335**
	54.0	2263		50.0	2198		51.0	2158
H414*	**53.0**	**2453**	**Re15**	**47.0**	**2371**	**IMR 4895**	**45.0**	**2333**
	49.0	2319		43.0	2203		41.0	2170
IMR 4350	**54.0**	**2449**	**H1000***	**61.0C**	**2371**	**IMR 4064**	**46.0**	**2312**
	50.0	2247		57.0	2152		42.0	2146
H4831*	**58.0C**	**2431**	**H380***	**50.0**	**2361**	Reduced Load **IMR 4198**	**31.0**	**1988**
	54.0	2205		46.0	2162		27.0	1721

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Larry Teague, RCBS Die Line employee, shot this broad beamed muley buck near Winnemucca, Nevada. (30-06, 165 gr. Grand Slam)

300 H&H MAGNUM

The famous British firm of Holland & Holland pioneered the belted rifle case before the first World War. The case design featured a pronounced raised belt of metal just ahead of the extraction cannelure to support the case for reliable headspace control in bolt action rifles. "Holland's Super 30" cartridge appeared around 1920 and later became known to the world as the 300 Holland & Holland Magnum.

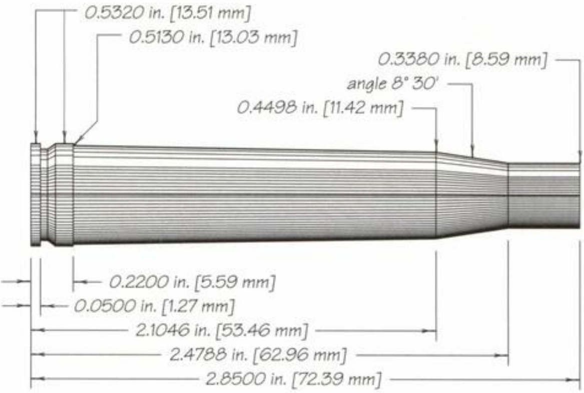
Because the new cartridge was significantly longer than the 30-06, there weren't any U.S. bolt-action rifles long enough to handle the 300 H&H in 1920. Rifles were either expensive English imports or custom models built on the equally costly Magnum Mauser action. Domestic ammunition was offered by Western Cartridge Company as early as 1925 but over a decade passed before the first American-built rifles appeared, encouraged by a major target shooting win.

In 1935, Ben Comfort won the prestigious 1000 yard Wimbledon Cup at the National Matches using a custom 300 H&H built by Griffin & Howe. His victory helped lead Winchester to chamber its new Model 70 for the 300 H&H in 1937. For the first time, there was a popularly-priced production rifle for the powerful 300 Magnum.

Until the introduction of the 300 Winchester Magnum in 1963, the H&H version was *the* 300 Magnum. It quickly established a reputation for accurate, flat-shooting power and has been used on almost every game species around the world. Because the case diameter is larger than the 30-06, the case holds more powder for a significant ballistic advantage. It was the parent to a staggering variety of both wildcat and commercial magnum cartridge. The belted case has become synonymous with the word "Magnum", although the 300 H&H and its big brother, the 375 H&H are the only bottleneck cartridges today which rely on the belt for headspace control. Newer magnum rifle cartridges have adequate shoulders for headspacing. However, it seems the shooting public wants a belt on anything called a "Magnum".

The 300 H&H can be loaded with the full range of Speer 30 caliber bullets. In spite of its tapered case and long, sloping shoulder, it remains today as one of the most efficient 30 caliber Magnums and delivers very respectable velocities with less propellant than the newer Magnums. The 300 H&H is probably more cartridge than needed for smaller deer. However, it is a potent cartridge for any other North American game with the exception of the largest bears. For long shots on mule deer, mountain sheep or goats, elk and moose, the 300 H&H is hard to beat.

The loads listed here do not exceed the SAAMI maximum average of 54,000 cup.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.3380 in. [8.59 mm]
angle 8° 30'
0.4498 in. [11.42 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.1046 in. [53.46 mm]
2.4788 in. [62.96 mm]
2.8500 in. [72.39 mm]

Max. Case Length: 2.850"
Trim-to Length: 2.840"
Max. Cart. Length: 3.600"
RCBS Shellholder: #4
Barrel Length: 26"
Twist: 1-10"

Test Firearm: Winchester Model 70
Case: W-W
Primers: CCI 200, 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	3.260"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**58.0**	**3367**	**H380***	**58.0**	**3030**	**748***	**55.0**	**2901**
	54.0	3148		54.0	2813		51.0	2655
IMR 4064	**56.0**	**3195**	**IMR 3031**	**51.0**	**2976**	**IMR 4350**	**58.0**	**2809**
	52.0	2973		47.0	2758		54.0	2604
IMR 4320	**56.0**	**3040**	**IMR 4198**	**43.0**	**2907**	Reduced Load **SR 4759**	**23.0**	**2016**
	52.0	2751		39.0	2591		19.0	1671

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. 110 Grain Sect. Density .166	30 HP					
Ballistic Coefficient	0.136					
C.O.L. Tested At	3.230"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4198	**43.0**	**2890**	IMR 3031	**51.0**	**2864**	SR 4759	**39.0**	**2842**
	39.0	2631		47.0	2588		35.0	2563
748*	**55.0**	**2876**	IMR 4895	**50.0**	**2850**	IMR 4320	**52.0**	**2825**
	51.0	2611		46.0	2636		48.0	2597
IMR 4064	**52.0**	**2874**	IMR 4350	**60.0**	**2849**	IMR 4227	**37.0**	**2688**
	48.0	2663		56.0	2651		33.0	2402

.308" Dia. 110 Grain Sect. Density .166	30 Carb. RN-SP	30 Carb. RN-FMJ	30 Spire-SP			
Ballistic Coefficient	0.144	0.179	0.273			
C.O.L. Tested At	3.300"	3.300"	3.430"			
Speer Part No.	1845	1846	1855			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**75.0**	**3662**	IMR 4064	**65.0**	**3515**	760*	**71.0**	**3462**
	71.0	3429		61.0	3345		67.0	3195
IMR 4831	**76.0C**	**3621**	AA 4350*	**77.0C**	**3508**	AA 3100*	**79.0C**	**3290**
	72.0	3384		73.0	3285		75.0	3074
H380*	**71.0**	**3570**	IMR 4895	**62.0**	**3486**	IMR 4320	**58.0**	**3275**
	67.0	3303		58.0	3265		54.0	3003
Re19*	**79.0**	**3538**	Viht. N160*	**74.0**	**3480**	Reduced Load SR 4759	**23.0**	**1968**
	75.0	3257		70.0	3259		19.0	1632

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: 125 gr. TNT is not recommended for this cartridge.

.308" Dia. **130 Grain** Sect. Density .196	**30** **HP**					
Ballistic Coefficient	0.263					
C.O.L. Tested At	3.440"					
Speer Part No.	2005					

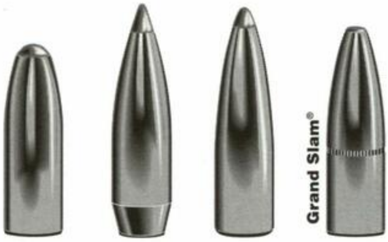
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**74.0C**	**3390**	**Re19***	**75.0C**	**3300**	**760***	**69.0**	**3195**
	70.0	3197		71.0	3098		65.0	2952
IMR 4350	**72.0C**	**3375**	**AA 3100***	**78.0C**	**3291**	**IMR 4895**	**59.0**	**3167**
	68.0	3129		74.0	3103		55.0	2982
IMR 3031	**59.0**	**3311**	**IMR 4064**	**62.0**	**3259**	**H380***	**62.0**	**3021**
	55.0	3094		58.0	3011		58.0	2765
AA 4350*	**74.0C**	**3301**	**Viht. N160***	**70.0**	**3227**	Reduced Load **SR 4759**	**24.0**	**1901**
	70.0	3060		66.0	2984		20.0	1572

Mag-Tip®
Grand Slam®

.308" Dia. **150 Grain** Sect. Density .226	**30** **RN-SP**	**30 BT** **FMJ**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**
Ballistic Coefficient	0.266	0.425	0.423	0.389	0.304	0.305
C.O.L. Tested At	3.385"	3.600"	3.500"	3.500"	3.520"	3.515"
Speer Part No.	2017	2018	2022	2023	2025	2026

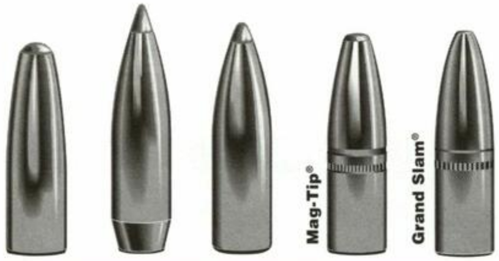
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**73.0C**	**3322**	**IMR 4064**	**61.0**	**3159**	**IMR 4895**	**57.0**	**2993**
	69.0	3133		57.0	2944		53.0	2737
IMR 4350	**70.0**	**3295**	**AA 3100***	**72.0**	**3142**	**IMR 4320**	**56.0**	**2918**
	66.0	3099		68.0	2963		52.0	2674
Re19*	**72.0**	**3223**	**AA 4350***	**68.0**	**3113**	**H380***	**61.0**	**2914**
	68.0	3004		64.0	2927		57.0	2651
Viht. N165*	**73.0**	**3178**	**IMR 3031**	**56.0**	**3102**	Reduced Load **SR 4759**	**27.0**	**1942**
	69.0	2984		52.0	2969		23.0	1648

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.308" Dia. **165 Grain** Sect. Density .248	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 GS-SP		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	3.345"	3.500"	3.500"	3.352"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831	**71.0**	**3185**	760*	**67.0**	**3024**	IMR 4895	**56.0**	**2881**
	67.0	2996		63.0	2777		52.0	2619
IMR 4350	**69.0**	**3185**	AA 4350*	**65.0**	**2940**	IMR 3031	**56.0**	**2872**
	65.0	2991		61.0	2766		52.0	2629
Re19	**67.0**	**3048**	Viht. N165	**67.0**	**2922**	AA 2700*	**58.0**	**2815**
	63.0	2874		63.0	2749		54.0	2660
IMR 4064	**60.0**	**3035**	AA 3100*	**68.0**	**2910**	Reduced Load SR 4759	**28.0**	**1908**
	56.0	2837		64.0	2728		24.0	1642



.308" Dia. **180 Grain** Sect. Density .271	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	3.430"	3.500"	3.500"	3.520"	3.515"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**68.0**	**3086**	H414*	**63.0**	**2892**	AA 4350*	**64.0**	**2832**
	64.0	2897		59.0	2652		60.0	2676
IMR 4831	**70.0**	**3039**	Viht. N165*	**67.5**	**2891**	Reduced Load IMR 4198	**35.0**	**2088**
	66.0	2853		63.5	2732		31.0	1841
Re22*	**70.0**	**2996**	IMR 4064	**58.0**	**2868**			
	66.0	2812		54.0	2619			
760*	**65.0**	**2921**	AA 3100*	**69.0**	**2850**			
	61.0	2688		65.0	2682			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.308" Dia.
200 Grain
Sect. Density .301

	30 Spitz-SP					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.500"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350	**66.0**	**2879**	**Re22***	**65.0**	**2774**	**Viht. N165**	**63.0**	**2687**
	62.0	2658		61.0	2605		59.0	2469
IMR 4831	**67.0**	**2844**	**H414***	**62.0**	**2767**	**AA 3100**	**63.0**	**2629**
	63.0	2660		58.0	2539		59.0	2484
H450*	**68.0**	**2836**	**AA 4350**	**61.0**	**2705**	Reduced Load **IMR 4198**	**36.0**	**2032**
	64.0	2657		57.0	2514		32.0	1818

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Idaho's Salmon River back country means a lot of uphill packing after a successful hunt. Travis and Steve Saleen take in the view above the main fork of the Salmon.

308 NORMA MAGNUM

The 308 Norma Magnum was developed around 1960 as another short, belted magnum cartridge suitable for use in converted 30-06 length actions. At that time, no commercial 30 caliber magnum used the shorter case and Norma saw the opportunity to enter the magnum market in a big way. They chose a unique method for introducing American shooters to their new cartridge.

In 1961, Norma made unprimed brass and loading data available in the U.S. and courted gunsmiths to start rechambering 30-06 rifles. To this end, they supplied chambering reamers on a "loaner" basis. This encouraged gunsmiths to build rifles and resulted in very uniform chambers. A good 30-06 sporter could be easily converted to the new magnum by opening the bolt face to accept the larger H&H case head diameter and rechambering.

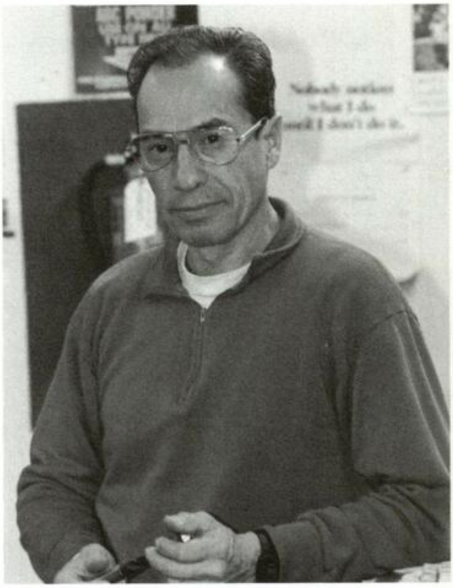
About a year later, Norma imported loaded ammunition for those who chose not to handload. Some factory European rifles were also chambered for the 308 Norma. The cartridge and the converted rifles were quite successful for a time, but the introduction of the 300 Winchester Magnum in 1963 and the availability of standard-price U.S. factory rifles and ammo diminished interest in the Norma cartridge.

There is little real difference in performance between the Norma and Winchester magnums. They can be used on the same type of game, so the one-gun hunter can be quite satisfied with the 308 Norma.

Although chamber uniformity is usually good with this cartridge, gunsmiths used different barrel throat lengths. Before reloading, establish the proper cartridge overall length which keeps the bullet from engaging the rifling before it is fired.

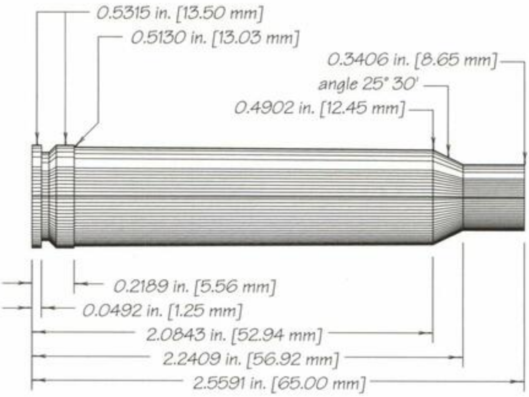
There are no U.S. pressure standards for this cartridge. Norma reports a maximum pressure of 55,100 psi. These loads were completely safe in the test rifle but, as with any cartridge, always begin with the published starting loads and work up carefully in your rifle.

If 308 Norma cases can't be found in your area, they can be readily formed from 338 Winchester cases by necking down in the sizer die and trimming if required.



Ray Navarro, RCBS Tool Crib/Safety & Environmental employee.

308 NORMA MAGNUM



0.5315 in. [13.50 mm]
0.5130 in. [13.03 mm]
0.3406 in. [8.65 mm]
angle 25° 30'
0.4902 in. [12.45 mm]
0.2189 in. [5.56 mm]
0.0492 in. [1.25 mm]
2.0843 in. [52.94 mm]
2.2409 in. [56.92 mm]
2.5591 in. [65.00 mm]

Max. Case Length: 2.559"
Trim-to Length: 2.549"
Max. Cart. Length: 3.415"
RCBS Shellholder: #4
Barrel Length: 24.5"
Twist: 1-12"

Test Firearm: SAKO
Case: Norma
Primers: CCI 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.870"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**77.0**	**3663**	**IMR 4895***	**63.0**	**3422**	**IMR 4198***	**50.0**	**3220**
	73.0	3411		59.0	3209		46.0	2977
H380*	**70.0**	**3497**	**IMR 4064***	**66.0**	**3388**	Reduced Load **SR 4759***	**22.0**	**1908**
	66.0	3289		62.0	3179		18.0	1570
IMR 3031*	**61.0**	**3448**	**IMR 4320***	**66.0**	**3367**			
	57.0	3231		62.0	3159			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Note: Limit velocities to 2900 fps.

.308" Dia. 110 Grain

Sect. Density .166

	30 HP					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.960"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**60.0**	**2909**	**IMR 3031***	**52.0**	**2880**	**SR 4759***	**41.0**	**2846**
	56.0	2692		48.0	2662		37.0	2562
IMR 4064*	**54.0**	**2882**	**H322***	**50.0**	**2879**	**IMR 4198***	**45.0**	**2844**
	50.0	2679		46.0	2631		41.0	2576
IMR 4895*	**52.0**	**2882**	**H380***	**57.0**	**2873**	**IMR 4350***	**62.0**	**2843**
	48.0	2669		53.0	2676		58.0	2648

.308" Dia. 110 Grain

Sect. Density .166

	30 RN-SP	30 Spire-SP				
Ballistic Coefficient	0.144	0.273				
C.O.L. Tested At	3.185"	3.185"				
Speer Part No.	1845	1855				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**76.0**	**3586**	**IMR 4350***	**77.0**	**3496**	**IMR 4320***	**65.0**	**3397**
	72.0	3362		73.0	3239		61.0	3137
IMR 4831*	**78.0**	**3521**	**IMR 3031***	**62.0**	**3482**	**IMR 4064***	**65.0**	**3482**
	74.0	3281		58.0	3202		61.0	3212
H380*	**70.0**	**3511**	**IMR 4895***	**63.0**	**3399**	**H322***	**56.0**	**3296**
	66.0	3252		59.0	3123		52.0	3154

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.308" Dia. **130 Grain** Sect. Density .195	**30 HP**	**30 Flat-SP**				
Ballistic Coefficient	0.263	0.248				
C.O.L. Tested At	3.185"	3.090"				
Speer Part No.	2005	2007				

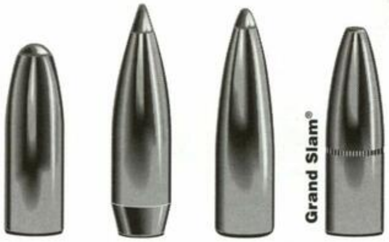
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**75.0**	**3382**	**IMR 4064***	**64.0**	**3318**	**H414***	**72.0**	**3270**
	71.0	3149		60.0	3062		68.0	3017
H380*	**70.0**	**3377**	**760***	**74.0**	**3295**	**IMR 4895***	**62.0**	**3134**
	66.0	3127		70.0	3049		58.0	2888
IMR 4831*	**76.0**	**3350**	**IMR 4320***	**64.0**	**3271**			
	72.0	3109		60.0	3003			

Mag-Tip®
Grand Slam®

.308" Dia. **150 Grain** Sect. Density .225	**30 RN-SP**	**30 BT Spitz-SP**	**30 Spitz-SP**	**30 MT-SP**	**30 GS-SP**	
Ballistic Coefficient	0.266	0.423	0.389	0.301	0.305	
C.O.L. Tested At	3.220"	3.300"	3.300"	3.230"	3.220"	
Speer Part No.	2017	2022	2023	2025	2026	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**74.0**	**3226**	**IMR 4895***	**62.0**	**3137**	**H414***	**66.0**	**2995**
	70.0	2986		58.0	2892		62.0	2751
H380*	**68.0**	**3222**	**IMR 4064***	**62.0**	**3145**	**760***	**67.0**	**2986**
	64.0	2977		58.0	2920		63.0	2762
H4831*	**75.0**	**3188**	**IMR 4320***	**63.0**	**3111**			
	71.0	2961		59.0	2869			

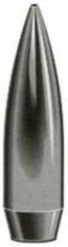
Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.308" Dia.
165 Grain
Sect. Density .247

	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 GS-SP		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	3.220"	3.400"	3.400"	3.230"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**74.0**	**3205**	**IMR 4064***	**61.0**	**3027**	**IMR 4320***	**61.0**	**2973**
	70.0	2962		57.0	2764		57.0	2728
IMR 4350*	**73.0**	**3182**	**IMR 4895***	**59.5**	**2978**	**760***	**65.0**	**2808**
	69.0	2941		55.5	2716		61.0	2582
H380*	**67.0**	**3107**	**AA 3100***	**71.0**	**2973**			
	63.0	2862		67.0	2814			

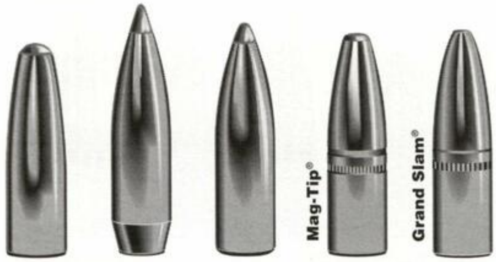


.308" Dia.
168 Grain
Sect. Density .253

	30 BT HP-Match					
Ballistic Coefficient	0.480					
C.O.L. Tested At	3.400"					
Speer Part No.	2040					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 3100*	**71.0**	**3102**	**IMR 7828***	**78.0**	**3014**	**IMR 4064***	**60.0**	**2903**
	67.0	2917		74.0	2843		56.0	2702
IMR 4831*	**72.0**	**3048**	**IMR 4320***	**59.0**	**2933**	**AA 8700***	**84.0**	**2813**
	68.0	2871		55.0	2709		80.0	2666
IMR 4350*	**69.0**	**3046**	**760***	**65.0**	**2909**			
	65.0	2712		61.0	2718			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.308" Dia. 180 Grain Sect. Density .271	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	3.220"	3.400"	3.400"	3.225"	3.225"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**71.0**	**3011**	IMR 7828*	**72.0**	**2840**	760*	**63.0**	**2737**
	67.0	2772		68.0	2674		59.0	2519
H380*	**63.0**	**2898**	IMR 4064*	**58.0**	**2814**	Reduced Load IMR 4198*	**31.0**	**1918**
	59.0	2652		54.0	2567		27.0	1681
AA 3100*	**67.0**	**2857**	IMR 4320*	**59.0**	**2806**			
	63.0	2653		55.0	2569			

.308" Dia. 200 Grain Sect. Density .301	30 Spitz-SP					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.400"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**70.0**	**2941**	AA 3100*	**67.0**	**2712**	H870*	**79.0**	**2569**
	66.0	2780		63.0	2552		75.0	2392
IMR 4350*	**69.0**	**2916**	IMR 4064*	**56.0**	**2643**	Reduced Load IMR 4198*	**32.0**	**1882**
	65.0	2733		52.0	2414		28.0	1654
H380*	**60.5**	**2717**	760*	**61.0**	**2617**			
	56.5	2497		57.0	2401			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

300 WINCHESTER MAGNUM

The 300 Winchester Magnum was the fourth in a line of commercial short magnum cartridges developed by Winchester starting in 1956 with the 458 Winchester Magnum. Introduced in 1963, the 300 Winchester was designed as a long-range, big game cartridge which could be chambered in standard (30-06) length actions. To accomplish this, Winchester engineers started with the 300 H&H case and shortened it to 2.62 inches. The Winchester case has a short neck and minimum body taper to maximize powder capacity. The cartridge has been an unqualified success by any standard.

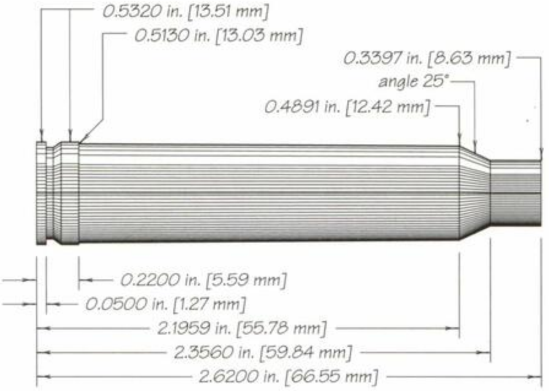
The popularity of the 300 Winchester has caused most rifle makers to drop the 300 H&H. Ballistically, the 300 Winchester is nearly equal to the longer 300 Weatherby Magnum. There is now a wide variety of rifle models available to the hunter shopping for a 300 Winchester Magnum and factory ammunition is readily available. The cartridge has proved very accurate and is commonly found in 1000 yard competition shooting.

Handloading for the 300 Winchester is straight-forward. Like other belted cartridges, the shoulder—not the belt—should be used for headspace control. Note that we used the CCI 250 Magnum primer for all the load data. The Ruger test rifle produced remarkably uniform velocities with most powders when bullet weights of 150 grains and heavier were used.

For large game where maximum penetration is important, Speer's 180 grain Speer Grand Slam is an excellent bullet. Its tough construction is required by the high-velocity, 30 caliber magnums to avoid bullet break-up. The 300 Winchester can be loaded with varmint weight bullets (except for the 125 grain TNT) and is quite accurate. However, the report and recoil may be more than the varmint shooter may enjoy in extended shooting sessions. Bullets lighter than 165 grains may lose excessive weight at close range when used on big game.

As you have seen from the other cartridge descriptions in this section, we feel that the various 30 calibers are just a bit light for the great bears. These cartridges will likely have little trouble killing a large bear that's not agitated but we prefer a heavier caliber when the bear is in a bad mood.

The SAAMI maximum average pressure for the 300 Winchester Magnum is 54,000 cup. These loads do not exceed that limit.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.3397 in. [8.63 mm]
angle 25°
0.4891 in. [12.42 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.1959 in. [55.78 mm]
2.3560 in. [59.84 mm]
2.6200 in. [66.55 mm]

Max. Case Length: 2.620"
Trim-to Length: 2.610"
Max. Cart. Length: 3.340"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Ruger 77 Mark II
Case: W-W
Primers: CCI 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.960"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15*	**72.0**	**3604**	**AA 2520***	**68.0**	**3479**	**IMR 4895***	**66.0**	**3381**
	68.0	3352		64.0	3253		62.0	3161
H322*	**65.0**	**3552**	**IMR 4064***	**69.0**	**3421**	**IMR 4320***	**68.0**	**3258**
	61.0	3339		65.0	3233		64.0	3095
Viht. N135*	**69.0**	**3543**	**H380***	**74.0**	**3396**	Reduced Load **SR 4759***	**23.0**	**1975**
	65.0	3330		70.0	3095		19.0	1626

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Note: Limit velocities to 2900 fps.

.308" Dia. 110 Grain

Sect. Density .166

	30 HP					
Ballistic Coefficient	0.136					
C.O.L. Tested At	2.990"					
Speer Part No.	1835					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**64.0**	**2857**	**IMR 4064***	**54.0**	**2849**	**SR 4759***	**42.0**	**2830**
	60.0	2666		50.0	2630		38.0	2548
IMR 4198*	**46.0**	**2857**	**H380***	**57.0**	**2846**	**IMR 4227***	**37.0**	**2571**
	42.0	2600		53.0	2611		33.0	2316
IMR 3031*	**52.0**	**2853**	**IMR 4895***	**54.0**	**2841**	**748***	**50.0**	**2497**
	48.0	2642		50.0	2619		46.0	2254

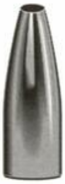
.308" Dia. 110 Grain

Sect. Density .273

	30 Spire-SP					
Ballistic Coefficient	0.273					
C.O.L. Tested At	3.215"					
Speer Part No.	1855					

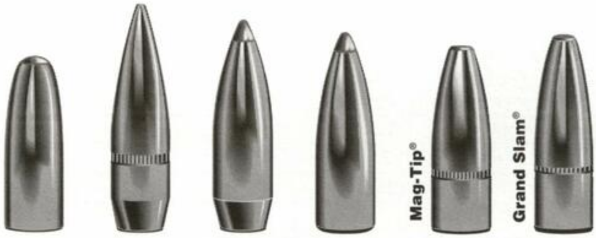
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**83.0**	**3599**	**H450***	**82.0**	**3551**	**AA 3100***	**83.0C**	**3495**
	79.0	3401		78.0	3302		79.0	3285
IMR 4350*	**80.0**	**3579**	**Re15***	**71.0**	**3542**	**H4831***	**84.0C**	**3397**
	76.0	3400		67.0	3294		80.0	3176
Re19*	**84.0**	**3574**	**H414***	**77.0**	**3535**	**IMR 4895***	**64.0**	**3379**
	80.0	3360		73.0	3305		60.0	3210
Viht. N135*	**68.0**	**3571**	**760***	**78.0**	**3521**	**IMR 3031***	**65.0**	**3320**
	64.0	3392		74.0	3275		61.0	3137
AA 4350*	**82.0**	**3566**	**IMR 4064***	**70.0**	**3496**	Reduced Load **SR 4759***	**25.0**	**2024**
	78.0	3334		66.0	3286		21.0	1718

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.308" Dia. **130 Grain** Sect. Density .196	**30** **HP**					
Ballistic Coefficient	0.263					
C.O.L. Tested At	3.260"					
Speer Part No.	2005					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160*	**80.0**	**3465**	**IMR 4350***	**77.0**	**3342**	**IMR 4064***	**66.0**	**3174**
	76.0	3222		73.0	2175		62.0	2984
H4350*	**78.0C**	**3385**	**H4831***	**82.0C**	**3291**	**Re12***	**62.0**	**3102**
	74.0	3165		78.0	3110		58.0	2900
IMR 4831*	**80.0**	**3379**	**Re15***	**67.0**	**3243**	**IMR 3031***	**61.0**	**3050**
	76.0	3193		63.0	3016		57.0	2882
AA 3100*	**82.0C**	**3363**	**H380***	**72.0**	**3213**	**IMR 4320***	**57.0**	**2738**
	78.0	3161		68.0	3052		53.0	2574



.308" Dia. **150 Grain** Sect. Density .226	**30** **RN-SP**	**30 BT** **FMJ**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**
Ballistic Coefficient	0.266	0.425	0.423	0.389	0.301	0.305
C.O.L. Tested At	3.150"	3.330"	3.330"	3.330"	3.290"	3.285"
Speer Part No.	2017	2018	2022	2023	2025	2026

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19*	**78.0C**	**3301**	**H450***	**77.0C**	**3174**	**H414***	**69.0**	**3071**
	74.0	3086		73.0	2968		65.0	2902
Re22*	**80.0C**	**3227**	**H4831***	**80.0C**	**3156**	**H380***	**69.0**	**3070**
	76.0	3001		76.0	2982		65.0	2855
AA 3100*	**80.0C**	**3225**	**IMR 4831***	**76.0**	**3118**	**AA 2700***	**69.0**	**3065**
	76.0	3064		72.0	2915		65.0	2881
H4350*	**76.0C**	**3219**	**IMR 4350***	**73.0**	**3091**	**Re15***	**64.0**	**3058**
	72.0	3026		69.0	2918		60.0	2890
Viht. N160*	**76.0**	**3199**	**760***	**68.0**	**3086**	Reduced Load **SR 4759***	**28.0**	**2028**
	72.0	2975		64.0	2932		24.0	1743

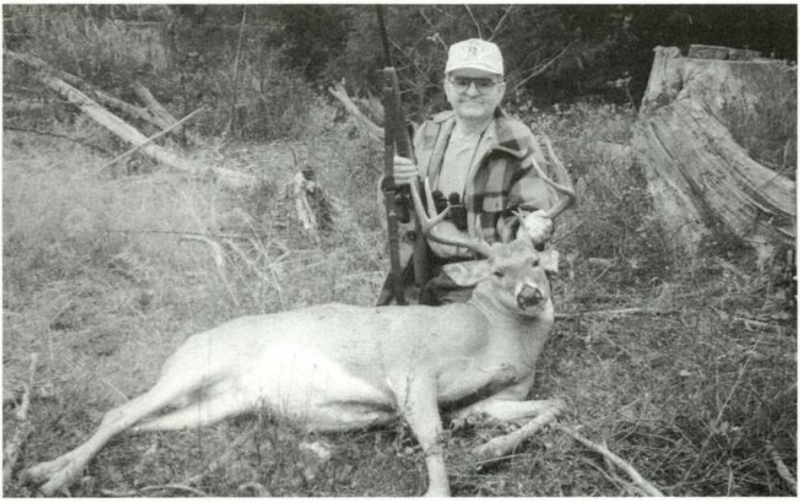
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. 165 Grain

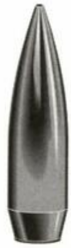
Sect. Density .248	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 GS-SP		
Ballistic Coefficient	0.274	0.471	0.433	0.393		
C.O.L. Tested At	3.200"	3.340"	3.340"	3.290"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**83.0C**	**3280**	**AA 4350***	**73.0**	**2994**	**H1000***	**81.0C**	**2883**
	79.0	3116		69.0	2844		78.0	2710
Re22*	**77.0C**	**3103**	**Viht. N160***	**72.0**	**2979**	**760***	**64.0**	**2873**
	73.0	2886		68.0	2785		60.0	2701
IMR 4350*	**74.0**	**3064**	**IMR 4831***	**73.0**	**2948**	**H4831***	**74.0**	**2856**
	70.0	2865		69.0	2742		69.0	2656
AA 3100*	**76.0C**	**3050**	**H414***	**67.0**	**2900**	**Re15***	**60.0**	**2809**
	72.0	2882		63.0	2726		56.0	2655
Re19*	**75.0**	**2997**	**IMR 4064***	**62.0**	**2894**	Reduced Load **SR 4759***	**29.0**	**2000**
	71.0	2802		58.0	2735		25.0	1763

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Vern Breazeal, CCI/Speer Safety Manager, is a believer in the 300 Winchester combined with the Speer 180 gr. Grand Slam. This nice Whitetail was taken on the North Fork of Idaho's Clearwater River. (.300 caliber, 180 gr. Grand Slam)



.308" Dia.
168 Grain
Sect. Density .114

	30 BT HP-Match					
Ballistic Coefficient	0.480					
C.O.L. Tested At	3.340"					
Speer Part No.	2040					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**79.0C**	**3190**	**Viht. N160***	**75.0**	**3138**	**H4831***	**77.0C**	**3005**
	75.0	2983		71.0	2965		73.0	2795
H4350*	**75.0**	**3174**	**IMR 7828***	**80.0C**	**3131**	**H380***	**67.0**	**2926**
	71.0	2984		76.0	2927		63.0	2750
IMR 4831*	**76.0C**	**3139**	**AA 3100***	**77.0C**	**3080**	**Re15***	**63.0**	**2911**
	72.0	2951		73.0	2926		59.0	2722
Re19*	**77.0**	**3138**	**IMR 4350***	**74.0**	**3063**	**H1000***	**81.0C**	**2856**
	73.0	2919		70.0	2895		77.0	2699

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Mag-Tip®
Grand Slam®

.308" Dia.
180 Grain

Sect. Density .271

	30 RN-SP	30 BT Spitz-SP	30 Spitz-SP	30 MT-SP	30 GS-SP	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	3.250"	3.340"	3.340"	3.285"	3.285"	
Speer Part No.	2047	2052	2053	2059	2063	

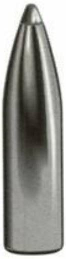
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19*	**76.0**	**3059**	**H1000***	**81.0C**	**2943**	**H870***	**86.0C**	**2817**
	72.0	2845		77.0	2781		82.0	2648
Re22*	**77.0C**	**3055**	**H4350***	**71.0**	**2938**	**760***	**65.0**	**2811**
	73.0	2844		67.0	2762		61.0	2670
IMR 7828*	**78.0C**	**2990**	**AA 3100***	**75.0C**	**2937**	**H414***	**64.0**	**2786**
	74.0	2818		71.0	2762		60.0	2647
IMR 4350*	**72.0**	**2988**	**H4831***	**75.0C**	**2934**	**AA 8700***	**86.0C**	**2716**
	68.0	2802		71.0	2743		82.0	2526
IMR 4831*	**73.0C**	**2951**	**Viht. N160***	**72.0**	**2925**	Reduced Load **IMR 4198***	**33.0**	**1998**
	69.0	2789		68.0	2754		29.0	1760

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **190 Grain** Sect. Density .286	**30 BT** **HP-Match**					
Ballistic Coefficient	0.540					
C.O.L. Tested At	3.340"					
Speer Part No.	2080					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**79.0C**	**3136**	**Viht. N160***	**72.0**	**3036**	**IMR 4350***	**70.0**	**2965**
	75.0	2916		68.0	2854		66.0	2817
Re19*	**76.0C**	**3097**	**H4350***	**71.0C**	**3003**	**H1000***	**79.0C**	**2909**
	72.0	2896		67.0	2838		75.0	2720
IMR 4831*	**74.0**	**3070**	**H4831***	**75.0C**	**2982**	**H870***	**86.0**	**2877**
	70.0	2901		71.0	2833		82.0	2690
Re22*	**76.0C**	**3056**	**AA 3100***	**70.0**	**2980**	**760***	**65.0**	**2861**
	72.0	2842		66.0	2801		61.0	2661

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.308" Dia. **200 Grain** Sect. Density .301	**30** **Spitz-SP**					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.340"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**75.0C**	**2856**	**Viht. N165***	**72.0**	**2767**	**AA 4350***	**67.0**	**2735**
	71.0	2656		68.0	2601		63.0	2544
Re22*	**73.0C**	**2852**	**Re19***	**71.0**	**2761**	**H4831***	**71.0C**	**2725**
	69.0	2652		67.0	2582		67.0	2548
IMR 4350*	**69.0**	**2843**	**H870***	**85.0C**	**2758**	**H450***	**69.0**	**2692**
	65.0	2672		81.0	2579		65.0	2530
H1000*	**77.0C**	**2797**	**760***	**64.0**	**2742**	**AA 3100***	**73.0C**	**2641**
	73.0	2629		60.0	2605		69.0	2496
H4350*	**69.0**	**2776**	**H414***	**64.0**	**2741**	Reduced Load **IMR 4198***	**35.0**	**2036**
	65.0	2637		60.0	2741		31.0	1812

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

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300 WEATHERBY MAGNUM

The 300 Weatherby Magnum was the first successful commercial improvement on the 300 H&H case. Roy Weatherby developed this cartridge during World War II by blowing out the full-length H&H case to give minimum body taper and adding the double-radius shoulder characteristic of his other cartridges. Commercial ammunition has been available from Weatherby since 1948. In recent years, Remington, Winchester and Ruger have produced rifles for this cartridge.

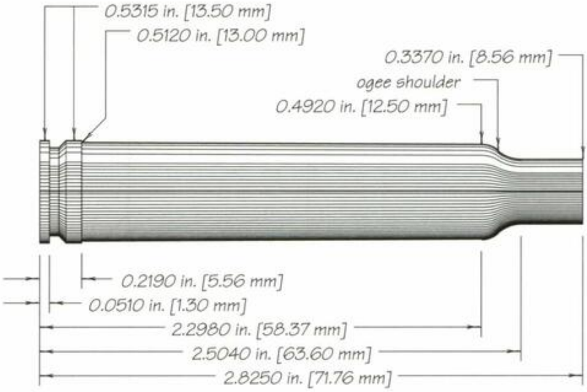
The 300 Weatherby is an impressive cartridge. It can launch 180 grain bullets at velocities in excess of 3000 feet/sec. Hunters have killed game up to the size of elephant with the 300 Weatherby, although we can't recommend this practice. The 300 Weatherby is very accurate, permitting long-range kills on most species of North American game. It has also been very successful on the African plains where shots are often long and the animals are tough.

Although too powerful for most deer, the big Weatherby cartridge is used on them anyway with spectacular results. Meat hunters will find that the 180 grain Hot-Cor or Mag Tip bullets kill deer just as dead as 150 grain bullets but without so much meat damage. For elk and moose, the 180 grain Speer Grand Slam is hard to beat. Its tough construction is sufficient to stand up to the high velocity of this cartridge. We feel heavier calibers are better suited for large North American bears; however, the 300 Weatherby will take one down with a well-placed shot. But, like the other 300 Magnums, it may not have the bone-breaking power to anchor a charging bruin.

Recoil of the 300 Weatherby is impressive and it is not the rifle for a beginner. It takes practice to master. It is, however, an easy cartridge to handload. Handloading also allows the shooter to reduce the power of the cartridge for off-season practice. Bullets weighing less than 130 grain produced large velocity variations with most powders, so we have shown only those propellants which minimize such variations. The 125 grain Speer TNT hollow point has a velocity limit of 3100 feet/sec is not recommended for the 300 Weatherby.

Weatherby factory rifles are free-bored; that is, the rifling in the barrel throat is relieved for a greater distance than found in most mass-produced rifles. Owners of custom rifles which lack the free-bore feature will need to reduce loads and make sure that the bullet ogive doesn't contact the rifling. Custom rifles may have dimensional differences from factory Weatherby rifles. Use care when working up loads in any custom rifle.

The SAAMI pressure limit for the 300 Weatherby is 65,000 psi. These loads do not exceed this value.


0.5315 in. [13.50 mm]
0.5120 in. [13.00 mm]
0.3370 in. [8.56 mm]
ogee shoulder
0.4920 in. [12.50 mm]
0.2190 in. [5.56 mm]
0.0510 in. [1.30 mm]
2.2980 in. [58.37 mm]
2.5040 in. [63.60 mm]
2.8250 in. [71.76 mm]

Max. Case Length: 2.825"
Trim-to Length: 2.815"
Max. Cart. Length: 3.560"
RCBS Shellholder: #4
Barrel Length: 26"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: R-P
Primers: CCI 250*

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	3.160"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064*	**72.0**	**3504**	**IMR 4350***	**79.0**	**3398**	**IMR 3031***	**67.0**	**3265**
	68.0	3309		75.0	3226		63.0	3070
760*	**77.0**	**3504**	**IMR 4320***	**70.0**	**3304**	Reduced Load **SR 4759***	**27.0**	**2021**
	73.0	3322		66.0	3115		23.0	1722

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Note: 110 gr. Varminter HP not recommended for this cartridge.

.308" Dia. **110 Grain** Sect. Density .166	**30** **RN-SP**	**30** **Spire-SP**				
Ballistic Coefficient	0.144	0.273				
C.O.L. Tested At	3.195"	3.335"				
Speer Part No.	1845	1855				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**87.0**	**3804**	**AA 4350***	**88.0**	**3748**	**H4350***	**85.0**	**3689**
	83.0	3629		84.0	3578		81.0	3515
H450*	**90.0**	**3795**	**Re19***	**90.0C**	**3722**	**AA 3100***	**89.0C**	**3607**
	86.0	3626		86.0	3557		85.0	3445
IMR 4895*	**75.0**	**3777**	**IMR 4831***	**88.5**	**3701**	Reduced Load **SR 4759***	**41.0**	**2838**
	71.0	3576		84.5	3534		37.0	2580

Note: 125 gr. TNT not recommended for this cartridge.

.308" Dia. **130 Grain** Sect. Density .196	**30** **HP**					
Ballistic Coefficient	0.263					
C.O.L. Tested At	3.530"					
Speer Part No.	2005					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**84.0**	**3558**	**IMR 7828***	**90.0C**	**3509**	**IMR 4895***	**72.0**	**3438**
	80.0	3389		86.0	3353		68.0	3247
IMR 4320*	**76.0**	**3547**	**AA 3100***	**87.0**	**3480**	**H4350***	**81.5**	**3425**
	72.0	3360		83.0	3320		77.5	3257
IMR 4831*	**86.0**	**3530**	**AA 4350***	**84.0**	**3468**	**H380***	**79.0**	**3400**
	82.0	3302		80.0	3303		75.0	3228
Re19*	**86.0**	**3521**	**H4831***	**89.0C**	**3445**	**H450***	**83.0**	**3394**
	82.0	3357		85.0	3290		79.0	3230

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

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.308" Dia. **150 Grain** Sect. Density .226	**30 RN-SP**	**30 BT Spitz-SP**	**30 Spitz-SP**	**30 MT-SP**	**30 GS-SP**	
Ballistic Coefficient	0.266	0.423	0.389	0.301	0.305	
C.O.L. Tested At	3.400"	3.560"	3.560"	3.495"	3.490"	
Speer Part No.	2017	2022	2023	2025	2026	

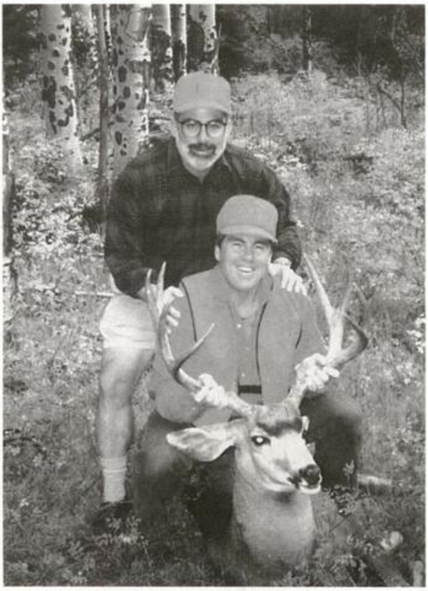
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**88.0C**	**3523**	**H1000***	**94.0C**	**3383**	**H380***	**78.0**	**3342**
	84.0	3363		90.0	3239		74.0	3171
IMR 7828*	**89.0C**	**3470**	**Viht. N160***	**82.5**	**3367**	**IMR 4320***	**73.0**	**3342**
	85.0	3314		78.5	3204		69.0	3159
IMR 4350*	**82.0**	**3426**	**H4350***	**81.0**	**3365**	**AA 4350***	**82.0**	**3341**
	78.0	3259		77.0	3198		78.0	3178
H4831*	**87.5**	**3404**	**Viht. N165***	**87.0**	**3361**	**H450***	**82.5**	**3310**
	83.5	3248		83.0	3207		78.5	3150
Re19*	**84.0**	**3396**	**AA 3100***	**85.0**	**3346**	Reduced Load **SR 4759***	**29.0**	**1970**
	80.0	3234		81.0	3189		25.0	1725

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **165 Grain** Sect. Density .248	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **GS-SP**		
Ballistic Coefficient	0.274	0.477	0.433	0.393		
C.O.L. Tested At	3.450"	3.560"	3.560"	3.495"		
Speer Part No.	2029	2034	2035	2038		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**85.0**	**3347**	**IMR 4350***	**80.0**	**3244**	**H450***	**81.0**	**3195**
	81.0	3190		76.0	3082		77.0	3037
IMR 7828*	**87.0C**	**3325**	**IMR 4064***	**73.0**	**3230**	**H380***	**76.0**	**3189**
	83.0	3172		69.0	3053		72.0	3021
H1000*	**93.0C**	**3317**	**Re19***	**82.0**	**3224**	**H4350***	**79.0**	**3172**
	89.0	3174		78.0	3067		75.0	3011
H4831*	**85.5**	**3265**	**Viht. N160***	**80.5**	**3200**	**AA 4350***	**79.0**	**3098**
	81.5	3112		76.5	3041		75.0	2941
AA 3100*	**84.0**	**3255**	**Viht. N165***	**84.5**	**3196**	Reduced Load **SR 4759***	**32.0**	**2007**
	80.0	3100		80.5	3045		28.0	1769

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Tom Fruechtel, Blount SED President, atop the Colorado muley he took with his "gun-bearer" Joe Murray, Ellet Bros. Distributors President. (.270 caliber, 150 gr. Grand Slam)

.308" Dia. **168 Grain** Sect. Density .253	**30 BT HP-Match**					
Ballistic Coefficient	0.480					
C.O.L. Tested At	3.560"					
Speer Part No.	2040					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**87.0**	**3361**	**H4831***	**85.5**	**3300**	**Viht. N160***	**79.0**	**3215**
	83.0	3207		81.5	3145		75.0	3053
Re19*	**82.0**	**3324**	**H1000***	**91.0C**	**3275**	**AA 4350***	**79.0**	**3211**
	78.0	3162		87.0	3131		75.0	3048
IMR 4831*	**82.0**	**3324**	**Viht. N165***	**84.0**	**3245**	**H380***	**75.5**	**3201**
	78.0	3162		80.0	3091		71.5	3032
AA 3100*	**84.0**	**3312**	**H450***	**81.0**	**3238**	**H4350***	**78.0**	**3199**
	80.0	3154		77.0	3078		74.0	3035
Re22*	**83.0**	**3304**	**IMR 4350***	**78.0**	**3231**			
	79.0	3145		74.0	3066			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Paul Snider, father of Jack Snider, CCI/Speer Primer Metal Parts employee, with his very nice Canadian Stone Ram 40" curl. (.270 caliber, 150 gr. Grand Slam)

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.308" Dia. **180 Grain** Sect. Density .271	**30** **RN-SP**	**30 BT** **Spitz-SP**	**30** **Spitz-SP**	**30** **MT-SP**	**30** **GS-SP**	
Ballistic Coefficient	0.304	0.540	0.483	0.352	0.416	
C.O.L. Tested At	3.450"	3.560"	3.560"	3.450"	3.450"	
Speer Part No.	2047	2052	2053	2059	2063	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**85.0**	**3212**	**AA 3100***	**82.0**	**3105**	**Re19***	**79.0**	**3011**
	81.0	3061		78.0	2954		75.0	2859
H1000*	**91.0C**	**3195**	**H870***	**96.0C**	**3100**	**Viht. N160***	**76.0**	**2992**
	87.0	3055		92.0	2971		72.0	2835
IMR 4831*	**81.0**	**3172**	**H450***	**80.0**	**3099**	**H4350***	**75.5**	**2965**
	77.0	3015		76.0	2944		71.5	2808
Re22*	**82.5**	**3163**	**Viht. N165***	**83.0**	**3093**	**AA 4350***	**76.0**	**2942**
	78.5	3010		79.0	2944		72.0	2787
H4831*	**83.0**	**3123**	**IMR 4350***	**77.0**	**3081**	Reduced Load **IMR 4198***	**35.0**	**1988**
	79.0	2973		73.0	2921		31.0	1763

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **190 Grain** Sect. Density .286	**30 BT HP-Match**					
Ballistic Coefficient	0.540					
C.O.L. Tested At	3.560"					
Speer Part No.	2080					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re22*	**80.0**	**3117**	**H450***	**78.0**	**3062**	**H380***	**72.0**	**3001**
	76.0	2961		74.0	2905		68.0	2835
IMR 7828*	**81.5**	**3116**	**IMR 4831***	**77.0**	**3039**	**Re19***	**77.0**	**2994**
	77.5	2963		73.0	2881		73.0	2839
Viht. N165*	**81.0**	**3073**	**IMR 4350***	**75.5**	**3039**	**H4350***	**75.0**	**2994**
	77.0	2921		71.5	2878		71.0	2834
AA 3100*	**80.0**	**3067**	**H4831***	**80.0**	**3031**	**Viht. N160***	**74.0**	**2903**
	76.0	2914		76.0	2880		70.0	2746
H870*	**95.0C**	**3064**	**H1000***	**86.0**	**3026**			
	91.0	2935		82.0	2885			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

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.308" Dia. **200 Grain** Sect. Density .301	30 Spitz-SP					
Ballistic Coefficient	0.556					
C.O.L. Tested At	3.560"					
Speer Part No.	2211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H870*	**93.0**	**2947**	**IMR 7828***	**79.0**	**2898**	**Re19***	**75.0**	**2787**
	89.0	2820		75.0	2751		71.0	2638
Re22*	**78.0**	**2943**	**IMR 4831***	**76.0**	**2868**	**H4350***	**73.0**	**2782**
	74.0	2792		72.0	2717		69.0	2630
IMR 4350*	**75.0**	**2940**	**H4831***	**77.5**	**2836**	**H1000***	**81.0**	**2746**
	71.0	2783		73.5	2690		77.0	2610
AA 3100*	**78.0**	**2926**	**H450***	**74.0**	**2813**	**AA 4350***	**73.0**	**2737**
	74.0	2776		70.0	2661		69.0	2587
Viht. N165*	**79.0**	**2909**	**H380***	**70.0**	**2804**	Reduced Load **IMR 4198***	**36.0**	**1971**
	75.0	2762		66.0	2644		32.0	1742

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

[Strong Rifle actions Only] 32-20 WINCHESTER

The 32-20 Winchester cartridge (also known as the 32 WCF) dates to 1882 when it was introduced in the famous Winchester Model 1873 lever action rifle. It became very popular as a varmint cartridge and was even touted as a deer cartridge. This last claim was grossly exaggerated because the 32-20 is by no means adequate for deer. The 32-20 was soon chambered in a wide variety of rifles and was also available in revolvers so the shooter could use the same ammo in both his rifle and sidearm. The low cost of ammunition made it a popular working rifle for ranchers, farmers and trappers who were more interested in practical performance than theoretical ballistics.

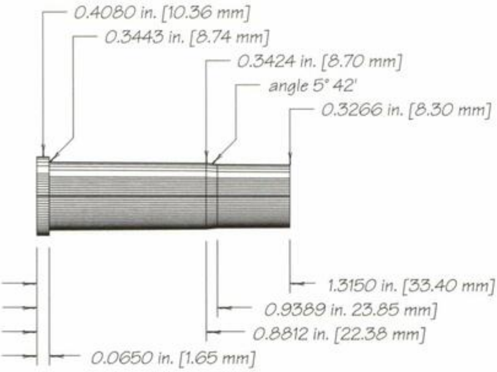
In a rifle with a nice bore, the 32-20 can be quite accurate. Its modest velocity and flat point bullets (required for tubular magazines) restrict the effective hitting range to under 150 yards, although it will kill (or wound!) at longer ranges. With non-expanding cast lead bullets, the 32-20 is a nice 100 yard turkey cartridge in areas where rifles are permitted for the big birds.

In its prime, 32-20 ammunition was sold in a variety of bullet weights, styles and velocities. In addition to lead bullets, soft point, full-jacket and hollow point bullets were available. There were two pressure levels, the higher intended for strong rifles only. The rifle load fired an 80 grain hollow point at 2100 feet/sec. Standard pressure loads originally used a 115 grain bullet which was later reduced to 100 grains. The high pressure rifles loads are no longer made because of industry concern that they would be dangerous if fired in poor-quality imported revolvers. Current factory ammo fires 100 grain lead or jacketed soft point bullets at a very leisurely 1200 feet/sec.

The handloader can improve this performance significantly if he plans to use a modern rifle such as the Marlin Model 1894 CL or the Browning Model 92. Original 1892 Winchesters in good condition can also handle somewhat higher loads. Have a gunsmith check out any original Model 92 Winchester before using the following loads.

The SAAMI pressure limit for the 32-20 is 16,000 cup. The loads shown here generate pressures up to 28,000 cup, the same as the 25-20 Winchester. THEY ARE ONLY FOR THE MARLIN MODEL 1894CL, THE BROWNING MODEL 92, AND ORIGINAL WINCHESTER MODEL 1892 RIFLES KNOWN TO BE IN GOOD CONDITION. THESE LOADS CANNOT BE USED IN THE WINCHESTER 1873 RIFLE OR ANY REVOLVER EXCEPT THE RUGER BLACKHAWK. DO NOT ATTEMPT TO USE POINTED BULLETS IN RIFLES WITH TUBULAR MAGAZINES. TO DO SO CAN CAUSE CARTRIDGES TO EXPLODE IN THE MAGAZINE, INJURING THE SHOOTER AND DAMAGING THE FIREARM.

32-20 WINCHESTER (RIFLE)



0.4080 in. [10.36 mm]
0.3443 in. [8.74 mm]
0.3424 in. [8.70 mm]
angle 5° 42'
0.3266 in. [8.30 mm]
1.3150 in. [33.40 mm]
0.9389 in. 23.85 mm]
0.8812 in. [22.38 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.315"
Trim-to Length: 1.305"
Max. Cart. Length: 1.592"
RCBS Shellholder: #1
Barrel Length: 22"
Twist: 1-20"

Test Firearm: Marlin 1894CL
Case: W-W
Primers: CCI 400

.312" Dia. **100 Grain** Sect. Density .147	**32** **JHP**
Ballistic Coefficient	0.167
C.O.L. Tested At	1.560"
Speer Part No.	3981

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296	**13.0**	**1881**	**IMR 4198**	**15.0C**	**1678**	**2400**	**9.0**	**1583**
	11.0	1635		13.0	1458		7.0	1377
H110	**13.0**	**1858**	**Viht. N110**	**10.5**	**1667**	**Viht. N120**	**13.0**	**1583**
	11.0	1624		8.5	1483		11.0	1420
SR 4759	**12.0**	**1735**	**AA 1680**	**14.5**	**1636**	**AA 2015BR**	**16.5**	**1462**
	10.0	1509		12.5	1414		14.5	1311
H4198	**15.0C**	**1679**	**Re7**	**16.0**	**1634**	**IMR 4227**	**11.0**	**1447**
	13.0	1477		14.0	1466		9.0	1259

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

7.62 x 39mm

This compact cartridge was developed by the Soviet military in answer to the effective German 8x33mm light assault rifle cartridge. Although the 8x33 was ballistically inferior to the standard 8x57mm service rifle cartridge, it was significantly more effective than the 9mm Luger cartridge used in submachine guns. The high rate of fire and effective range of the shorter cartridge (some 400 meters) made an impact on the Russians, who quickly copied it. The Russian version (the Model 43) was was initially chambered in the semi-automatic SKS rifle and later in the Automat Kalashnikov Model 47—the AK-47. This cartridge became the primary service cartridge for most Eastern Bloc countries. Typically, it fires a 123 grain FMJ bullet at a nominal 2350 feet/sec.

The 7.62x39 cartridge was little known in this country until the Viet Nam conflict. During the last decade, a large number of rifles have been imported into this country. As a result, the cartridge is gaining in reloading popularity.

Boxer-primed cases suitable for reloading are now available from several sources. The standard bullet diameter for the 7.62x39 is .311". Speer offers two bullets—a 123 grain FMJ bullet which duplicates the military load and a 125 grain Hot-Cor soft point for hunting. The 7.62x39 case is bottlenecked and handloading procedures are the same as for any similar cartridge. Some makes of reloadable cases require small rifle primers; check your cases before loading and sort them accordingly. We used a Ruger bolt-action rifle in our tests; velocities in semi-automatic carbines will typically be 100 feet/sec slower.

Like the 30 Carbine cartridge, the 7.62x39 is one of those "in between" cartridges. It is similar in performance to the 30-30 Winchester and some surplus rifles show reasonable accuracy. Because the cartridge cannot use heavier bullets, we feel that it is best limited to animals no larger than small deer, using the soft point bullet for humane kills.

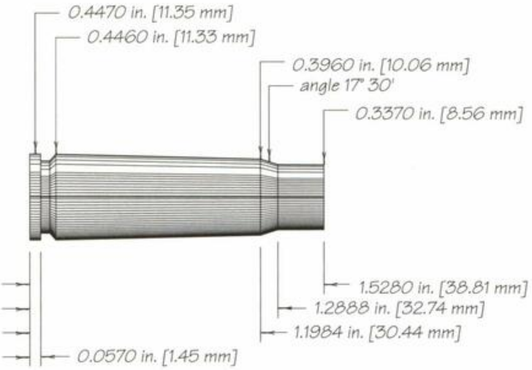
Thousands of rounds of surplus, steel-case 7.63x39 ammunition have been imported in recent years. They are not suitable for reloading. Before reloading, sort brass carefully to remove all steel or Berdan-primed cases. A large magnet is useful in detecting steel cases.

NOTE: Many variants of the SKS rifle lack a firing pin retractor spring. These may inadvertently slam-fire (the cartridge fires as the bolt closes). High-seated primers and dirty chambers can contribute to this phenomenon. Seat all primers .003" to .005" below flush and keep the chamber clean. If your rifle slam-fires, discontinue its use immediately until you can have the rifle checked by a gunsmith familiar with these rifles. The CCI No. 34 primer has mil-spec sensitivity and can reduce the chance of a slam-fire.

The SAAMI maximum average pressure of this cartridge is established at 50,000 cup. These loads remain within this limit.

Don Zuck, CCI/Speer Primer Engineer, proves the viability of the SKS as a sporting rifle. (SKS, 125 gr. Hot-Cor)

7.62 x 39 mm


0.4470 in. [11.35 mm]
0.4460 in. [11.33 mm]
0.3960 in. [10.06 mm]
angle 17° 30'
0.3370 in. [8.56 mm]
1.5280 in. [38.81 mm]
1.2888 in. [32.74 mm]
1.1984 in. [30.44 mm]
0.0570 in. [1.45 mm]

Max. Case Length: 1.528"
Trim-to Length: 1.518"
Max. Cart. Length: 2.200"
RCBS Shellholder: #32
Barrel Length: 22"
Twist: 1-10"

Test Firearm: Ruger Model 77 Mark II
Case: IMI
Primers: CCI 200, No. 34

125 Grain
123 Grain

.311" Dia. **123 Grain** **125 Grain**	**303 Spitz-SP**	**303 FMJ**				
Sectional Density	0.182	0.185				
Ballistic Coefficient	0.292	0.256				
C.O.L. Tested At	2.150"	2.150"				
Speer Part No.	2213	2214				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**28.0**	**2544**	Viht. N120	**24.0**	**2350**	BL-C(2)	**31.5C**	**2250**
	26.0	2422		22.0	2206		29.5	2115
Re7	**27.0**	**2429**	H322	**29.0C**	**2343**	IMR 4227	**21.0**	**2214**
	25.0	2280		27.0	2195		19.0	1976
AA 2015BR	**28.5C**	**2410**	H335	**31.5C**	**2325**	IMR 4895	**29.0C**	**2198**
	26.5	2246		29.5	2174		27.0	2088
IMR 4198	**26.0C**	**2402**	AA 2230	**30.0C**	**2308**			
	24.0	2246		28.0	2198			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

303 BRITISH

Although not very popular in the United States, this old British service cartridge has seen extensive use in the rest of the world, and particularly in those countries which were once part of the vast British Commonwealth. The 303 was adopted as a service cartridge in 1888 in the Lee-Medford Mk I rifle and carbine. Original military ammo featured a 215 grain full-jacketed bullet over a charge of black powder. Later, smokeless powder loads using Cordite were introduced. During the first World War, a 174 grain spitzer bullet at 2400 feet/sec was adopted as the Mk VII round. The military 303 cartridge used this basic configuration until it was replaced by the 7.62mm NATO round in 1957.

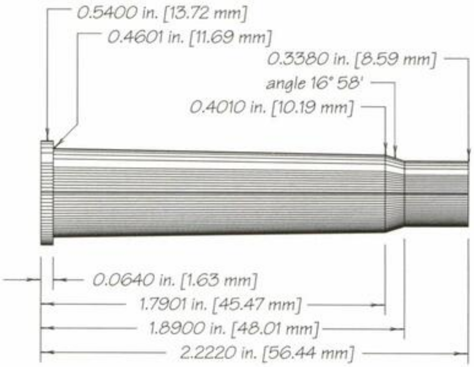
Soft point hunting ammunition for the 303 has been loaded with both 215 and 170 grain bullets. The famous Short Magazine Lee-Enfield rifle—the SMLE—has been widely distributed as a surplus item. One of the nicest variations is the light and handy No. 5 Mark I*—the Jungle Carbine. It can be used as a hunting rifle without any modification other than the fitting a five-shot magazine.

The 303 is ballistically equivalent to the 30-40 Krag, and can be used on the same types of game with proper bullet selection. The reloader should use .311" or .312" bullets. True 30 caliber bullets are .308" in diameter and will seldom give good accuracy. Speer makes three Hot-Cor bullets in .311" diameter. The 150 and 170 grain bullets are the best choices for deer. However the 125 grain bullet, although designed for the 7.62x39mm cartridge, shot surprisingly well in our test rifle. This bullet can be used on varmints up to the size of coyotes.

Lee-Enfield rifles were made in a dizzying number of variations but all share one common feature. The bolt locks at the rear causing the action to be somewhat springy. This limits the 303 to rather modest pressures and case life is usually short. Cases can be used for full-power loads for two firings but then must be relegated for use with lighter practice loads. Check often for signs of incipient case head separations.

Surplus rifles show a wide variation in condition, and some may have excessive headspace. Have your rifle thoroughly checked by a competent gunsmith before attempting to fire it with any ammunition. Lee-Enfields have replaceable bolt heads so correcting headspace problems is not hard if you can find a supply of proper-size replacement heads. Another 303 service rifle, the Enfield Pattern 14, uses a Mauser-type lock-up. It is much stronger than any Lee-Enfield, but is not as common on the surplus market.

Factory ammunition is loaded to less than 45,000 cup in deference to the SMLE action. These loads were safe in the test rifle but, as always, maximum loads should only be approached with caution.


0.5400 in. [13.72 mm]
0.4601 in. [11.69 mm]
0.3380 in. [8.59 mm]
angle 16° 58'
0.4010 in. [10.19 mm]
0.0640 in. [1.63 mm]
1.7901 in. [45.47 mm]
1.8900 in. [48.01 mm]
2.2220 in. [56.44 mm]

Max. Case Length: 2.222"
Trim-to Length: 2.212"
Max. Cart. Length: 3.075"
RCBS Shellholder: #7
Barrel Length: 25.25"
Twist: 1-8"

Test Firearm: Enfield (SMLE)
Case: R-P
Primers: CCI 200, 250

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	2.567"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**44.0**	**2933**	**IMR 4064**	**46.0**	**2882**	**748***	**48.0**	**2811**
	40.0	2671		42.0	2637		44.0	2541
IMR 4320	**48.0**	**2924**	**H380***	**51.0**	**2841**	**H414***	**51.0**	**2584**
	44.0	2693		47.0	2617		47.0	2396
IMR 4895	**45.0**	**2907**	**IMR 4350**	**50.0**	**2618**	Reduced Load **SR 4759**	**20.0**	**1980**
	41.0	2663		46.0	2430		16.0	1587

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.311" Dia. 123 Grain 125 Grain	303 Spitz-SP	303 FMJ				
Sectional Density	0.182	0.184				
Ballistic Coefficient	0.256	0.292				
C.O.L. Tested At	2.915"	2.915"				
Speer Part No.	2213	2214				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**49.0**	**2979**	AA 2230	**43.0**	**2790**	H380*	**48.0**	**2700**
	45.0	2803		39.0	2602		44.0	2534
BL-C(2)*	**49.0**	**2944**	IMR 4064	**46.0**	**2788**	H414*	**51.0**	**2666**
	45.0	2751		42.0	2531		47.0	2458
IMR 4895	**45.0**	**2840**	Re15	**46.5**	**2775**	760*	**51.0**	**2646**
	41.0	2656		42.5	2570		47.0	2464
AA 2520*	**44.0**	**2816**	748*	**48.0**	**2744**	IMR 4350	**50.0**	**2601**
	40.0	2615		44.0	2562		46.0	2427

.311" Dia. 150 Grain Sect. Density .221	303 Spire-SP					
Ballistic Coefficient	0.411					
C.O.L. Tested At	3.075"					
Speer Part No.	2217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**48.0**	**2631**	IMR 4350	**50.0**	**2584**	H380*	**44.0**	**2470**
	44.0	2418		46.0	2391		40.0	2262
IMR 4895	**42.0**	**2594**	760*	**48.0**	**2575**	Reduced Load SR 4759	**25.0**	**1925**
	38.0	2343		44.0	2319		21.0	1613
IMR 4320	**44.0**	**2585**	IMR 4064	**43.0**	**2554**			
	40.0	2348		39.0	2319			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.311" Dia. **180 Grain** Sect. Density .265	**303** **RN-SP**					
Ballistic Coefficient	0.328					
C.O.L. Tested At	3.075"					
Speer Part No.	2223					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**46.0**	**2439**	**IMR 4350**	**46.0**	**2375**	**IMR 4064**	**40.0**	**2283**
	42.0	2219		42.0	2183		36.0	2049
760*	**45.0**	**2439**	**IMR 4895**	**40.0**	**2320**	Reduced Load **IMR 4198**	**25.0**	**1839**
	41.0	2197		36.0	2083		21.0	1543
IMR 4831	**47.0**	**2421**	**IMR 4320**	**41.0**	**2288**			
	43.0	2218		37.0	2073			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

32 WINCHESTER SPECIAL

The 32 Winchester Special (not to be confused with the smaller 32-20) was a companion cartridge to the 30-30. It also appeared in 1895 in Winchester's Model 1894 lever action rifles and carbines. The cartridge existed to fill a need unique to the time period. At the turn of the century, handloaders were restricted to black powder usually loaded with bulk powder scoops. Smokeless powders were so new that they were not generally available to reloaders and were definitely not suitable for bulk loading with the precalibrated scoops designed for black powder. Even smokeless powder cartridges like the 30-30 and the 30-40 Krag were commonly reloaded with black powder until better smokeless powder technology was available.

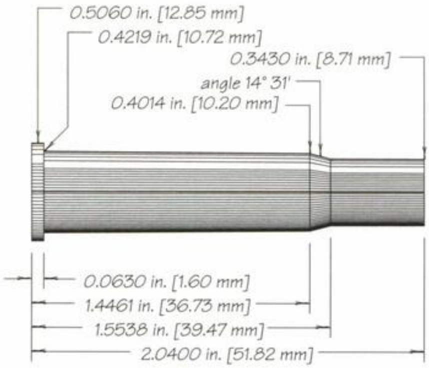
Barrels for the 30-30 cartridge used a 1-in-12 inch rifling twist. Black powder reloads tended to foul fast-twist barrels badly. The 32 Special was developed with a slower 1-in-16 inch twist to reduce fouling. Factory ammo was loaded with smokeless powder and reloaders could use black powder in the 32 without the fouling problems associated with the 30-30. Winchester at one time offered a dual-range rear sight for Model 94's in 32 Special. One setting was used for factory loads and the other was used for the lower velocity black powder reloads.

Although many articles and camp fire discussions have compared the relative merits of the 30-30 and the 32 Special, there is really no difference in game performance. However, one real difference between the two cartridges becomes apparent when the rifle bores become worn through use or neglect. The 30-30 with its 12 inch twist will shoot reasonably well even when heavily worn. The slower twist in the 32 Special will give very poor accuracy once the barrel becomes even slightly worn.

The 32 Winchester Special requires a .321" diameter bullet. Speer makes just one bullet in this diameter, a Hot-Cor design with a flat point and crimping cannelure for use in tubular magazines. The cartridge is headed for obsolescence and no new rifles have been produced since the 1960's. However, the handloader can keep his rifle shooting for many years.

These data can also be used for the 32 Remington cartridge, which is a rimless version designed for Remington slide-actions and autoloaders. These loads are within the industry working pressure of 38,000 cup.

32 WINCHESTER SPECIAL


0.5060 in. [12.85 mm]
0.4219 in. [10.72 mm]
0.3430 in. [8.71 mm]
angle 14° 31'
0.4014 in. [10.20 mm]
0.0630 in. [1.60 mm]
1.4461 in. [36.73 mm]
1.5538 in. [39.47 mm]
2.0400 in. [51.82 mm]

Max. Case Length: 2.040"
Trim-to Length: 2.030"
Max. Cart. Length: 2.565"
RCBS Shellholder: #2
Barrel Length: 20"
Twist: 1-16"

Test Firearm: Winchester Model 94
Case: W-W
Primers: CCI 200, 250

.321" Dia. **170 Grain** Sect. Density .236	**32** **Flat-SP**					
Ballistic Coefficient	0.297					
C.O.L. Tested At	2.560"					
Speer Part No.	2259					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**35.0**	**2205**	**IMR 4064**	**36.0**	**2172**	**IMR 4198**	**25.5**	**2062**
	33.0	2067		34.0	2038		23.5	1906
IMR 3031	**34.0**	**2201**	**BL-C(2)***	**33.0**	**2166**	**IMR 4350**	**37.0**	**1944**
	32.0	2058		31.0	2019		35.0	1829
748*	**36.0**	**2197**	**IMR 4320**	**35.5**	**2070**	Reduced Load **SR 4759**	**18.0**	**1710**
	34.0	2062		33.5	1941		16.0	1529

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

8mm MAUSER (8 x 57mm JS)

The 8mm Mauser was adopted as the German service rifle cartridge in 1888. It became as popular in Europe as the 30-06 is here, both for military and sporting use. The 8x57 was the first smokeless powder cartridge adopted by any major military organization. Original loads featured a 227 grain round nose bullet which was .318" in diameter. In 1905, a high-velocity version, often known as the JS, was adopted. The JS cartridge used 150 grain spitzer bullets of .323" diameter for improved long-range performance. Rifles for the new high-velocity loads had much stronger actions than the original Model 1888.

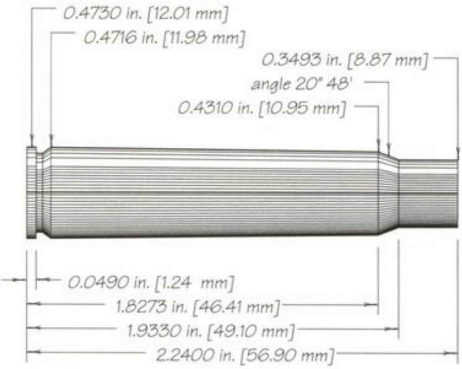
The 8mm Mauser was never chambered in any U.S. sporting rifles other than a short run of the Model 54 Winchester. However, the influx of surplus military rifles in this caliber have kept it alive and RCBS die sales tell us that there continues to be a lot of interest in handloading this cartridge.

Part of the handloading interest can be traced to the low power of U.S. factory ammunition. Because of industry concerns over shooters using JS-type ammunition in the weak (and tight-bored) Model 1888 action, the industry pressure limit is set unusually low—37,000 cup. As a result, the performance of 8mm Mauser factory ammo is rather modest—not much better than a 30-30. European ammunition is loaded to higher limits and allows the true nature of the cartridge to be experienced. Handloaded to higher pressures, the 8mm Mauser is close to the 308 Winchester in power and is suitable for most North American game except the great bears.

In a quality Model 98 Mauser in good condition, the handloader can have a very versatile hunting rifle. However, because military Mausers have been built at arsenals around the world, quality varies considerably. You should also be aware that many surplus rifles had the bolts mixed during shipping or storage and even a quality surplus Mauser may not have its original bolt. IT IS VERY IMPORTANT THAT ANY SURPLUS RIFLES BE INSPECTED FOR HEADSPACE AND OVERALL QUALITY BEFORE ATTEMPTING TO FIRE THEM WITH ANY AMMUNITION.

Speer makes three Hot-Cor bullets suitable for the 8mm Mauser. The 150 grain spitzer is a fine, all-around bullet and the 170 grain semi-spitzer is an excellent woods bullet. The 200 grain spitzer was really designed for the 8mm Remington Magnum; however, it can be used for close shots on elk and moose in the 8mm Mauser at maximum permissible velocities.

We developed the following loads along European guidelines, so these exceed the SAAMI pressure limit. Pressures approach 50,000 cup. Do not use THESE LOADS IN ANY 8MM RIFLES OTHER THAN MODEL 98 MAUSERS WHICH HAVE BEEN INSPECTED BY A GUNSMITH FAMILIAR WITH THESE ACTIONS. DO NOT USE THESE LOADS IN ANY RIFLE WHICH HAS THE SMALLER .318" BORE.


0.4730 in. [12.01 mm]
0.4716 in. [11.98 mm]
0.3493 in. [8.87 mm]
angle 20° 48'
0.4310 in. [10.95 mm]
0.0490 in. [1.24 mm]
1.8273 in. [46.41 mm]
1.9330 in. [49.10 mm]
2.2400 in. [56.90 mm]

Max. Case Length: 2.240"
Trim-to Length: 2.230"
Max. Cart. Length: 3.250"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-9.5"

Test Firearm: Mauser M98 VZ24
Case: R-P
Primers: CCI 200, 250

.323" Dia. **150 Grain** Sect. Density .205	**8mm Spitz-SP**					
Ballistic Coefficient	0.369					
C.O.L. Tested At	2.898"					
Speer Part No.	2277					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**51.0**	**2915**	**H322**	**48.0**	**2699**	**AA 2700***	**50.0**	**2580**
	47.0	2695		44.0	2433		46.0	2358
H335*	**50.0**	**2771**	**Viht. N140**	**50.0**	**2695**	**BL-C(2)***	**44.0**	**2544**
	46.0	2513		46.0	2436		40.0	2324
IMR 3031	**49.0**	**2757**	**IMR 4895**	**48.0**	**2675**	**AA 4350**	**56.0C**	**2507**
	45.0	2488		44.0	2428		52.0	2317
Re15	**51.0**	**2726**	**IMR 4350**	**55.0C**	**2660**	Reduced Load **IMR 4198**	**26.0**	**1955**
	47.0	2439		51.0	2458		22.0	1663

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.323" Dia.
170 Grain
Sect. Density .232

	8mm SSpitz-SP					
Ballistic Coefficient	0.354					
C.O.L. Tested At	2.890"					
Speer Part No.	2283					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**49.0**	**2723**	IMR 4350	**55.0C**	**2632**	H335*	**46.0**	**2525**
	45.0	2509		51.0	2429		42.0	2262
748*	**54.0**	**2716**	IMR 3031	**44.0**	**2600**	AA 2700*	**49.0**	**2486**
	50.0	2451		40.0	2356		45.0	2266
IMR 4895	**46.0**	**2640**	H380*	**54.0**	**2588**	AA 4350	**53.0C**	**2368**
	42.0	2401		50.0	2359		49.0	2185
Re15	**49.0**	**2632**	Viht. N140	**48.0**	**2574**	Reduced Load IMR 4198	**27.0**	**1914**
	45.0	2425		44.0	2378		23.0	1642

.323" Dia.
200 Grain
Sect. Density .274

	8mm Spitz-SP					
Ballistic Coefficient	0.411					
C.O.L. Tested At	3.200"					
Speer Part No.	2285					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**52.0**	**2469**	760*	**52.0**	**2392**	Viht. N140	**43.0**	**2242**
	48.0	2242		48.0	2171		39.0	2040
IMR 4064	**46.0**	**2434**	AA 2700*	**48.0C**	**2324**	AA 4350	**50.0C**	**2149**
	42.0	2196		44.0	2110		46.0	2022
IMR 4350	**53.0C**	**2432**	H335*	**42.0**	**2322**	Reduced Load IMR 4198	**28.0**	**1726**
	49.0	2208		38.0	2066		24.0	1459
IMR 4831	**54.0C**	**2395**	Re15	**44.0**	**2267**			
	50.0	2213		40.0	2051			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

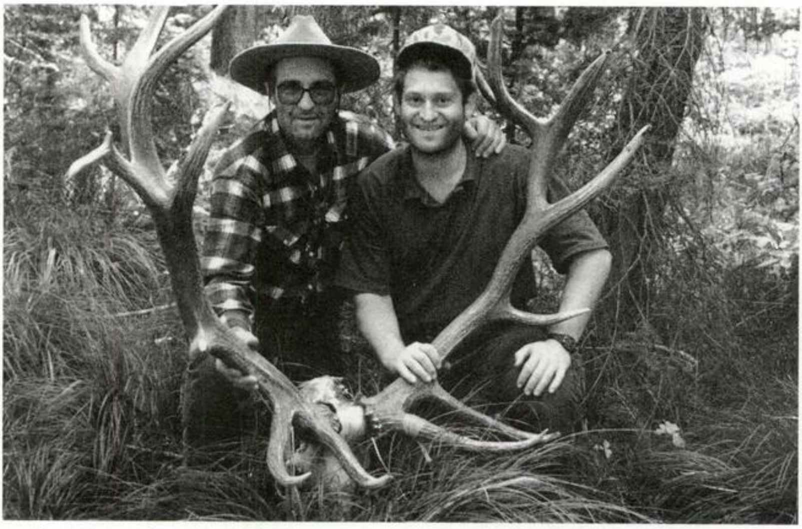
8mm-06

Wildcat cartridges come and go and some have proved their worth better than others. The 8mm-06 is one of those, arising from a very practical need. Owners of surplus 8mm Model 98 Mauser rifles wanted a way to improve the power of their rifles at minimum expense. The solution was to simply rechamber the rifle to handle a 30-06 case necked up to hold 0.323" bullets. The result is a happy combination. Cheap 30-06 brass is plentiful and the handloader has a reasonable selection of good bullets. The only limitation of the 8mm-06 is that no true varmint-type bullets are available in this caliber.

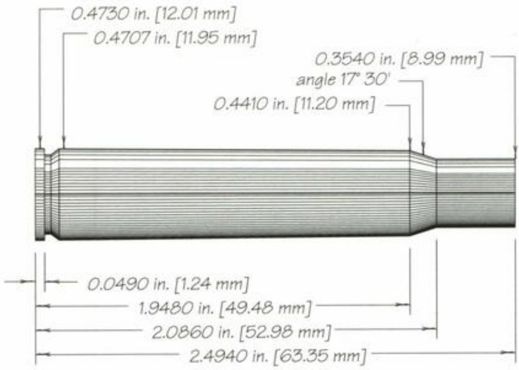
As a hunting cartridge, the 8mm-06 is equal to the 30-06 in all respects and can be used on the same types of game. Case-forming can usually be accomplished in the sizer die alone. Bullet recommendations are the same as in the text for the 8mm Mauser cartridge.

When considering the conversion to 8mm-06, you must make certain that the rifle has the later .323" diameter barrel and not the older .318" barrel. Rifles having the smaller bore diameter also have weaker actions making them unsuitable for conversion to any modern, high-pressure cartridge. Have the rifle thoroughly checked before committing to such a conversion.

Since the 8mm-06 is a wildcat cartridge, no pressure standards exist for it. These loads are estimated to produce pressures similar to the 30-06—up to 50,000 cup. Reloading dies for the 8mm-06 are available from the RCBS Special Order Die department.



Arlen Chaney, former SED President, and son Dale sharing one of many successful father and son hunting trips. Memories that last a lifetime— generation to generation.


0.4730 in. [12.01 mm]
0.4707 in. [11.95 mm]
0.3540 in. [8.99 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.0860 in. [52.98 mm]
2.4940 in. [63.35 mm]

Max. Case Length: 2.494"
Trim-to Length: 2.484"
Max. Cart. Length: 3.250"
RCBS Shellholder: #3
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Mauser M98 (Rechambered)
Case: W-W
Primers: CCI 200, 250

.323" Dia. **150 Grain** Sect. Density .205	**8mm Spitz-SP**					
Ballistic Coefficient	0.369					
C.O.L. Tested At	3.250"					
Speer Part No.	2277					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**53.0**	**2981**	H380*	**59.0C**	**2844**	748*	**55.0**	**2795**
	49.0	2509		55.0	2662		51.0	2552
IMR 4064	**55.0C**	**2881**	760*	**62.0**	**2826**	IMR 4895	**52.0**	**2786**
	51.0	2585		58.0	2581		48.0	2523
IMR 4320	**54.0**	**2849**	IMR 3031	**52.0C**	**2806**	IMR 4350	**59.0C**	**2677**
	50.0	2614		48.0	2482		55.0	2463

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.323" Dia.
170 Grain
Sect. Density .232

	8mm SSpitz-SP					
Ballistic Coefficient	0.354					
C.O.L. Tested At	3.250"					
Speer Part No.	2283					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**51.0**	**2762**	**760***	**62.0C**	**2643**	**IMR 4350**	**58.0C**	**2580**
	47.0	2513		58.0	2418		54.0	2355
IMR 4064	**54.0C**	**2675**	**IMR 4320**	**53.0**	**2640**	**IMR 4831**	**60.0C**	**2576**
	50.0	2437		49.0	2406		56.0	2352
H380*	**59.0C**	**2653**	**748***	**54.0**	**2619**	**IMR 4895**	**50.0**	**2543**
	55.0	2551		50.0	2369		46.0	2303

.323" Dia.
200 Grain
Sect. Density .274

	8mm Spitz-SP					
Ballistic Coefficient	0.411					
C.O.L. Tested At	3.250"					
Speer Part No.	2285					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**53.0C**	**2647**	**BL-C(2)***	**49.0**	**2599**	**IMR 4350**	**58.0C**	**2580**
	49.0	2411		45.0	2353		54.0	2347
760*	**62.0C**	**2615**	**H380***	**57.0C**	**2595**	**IMR 4831**	**60.0C**	**2546**
	58.0	2411		53.0	2367		56.0	2337
IMR 4320	**52.0**	**2612**	**748***	**53.0**	**2583**	**IMR 3031**	**48.0**	**2429**
	48.0	2354		49.0	2341		44.0	2194

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

8mm REMINGTON MAGNUM

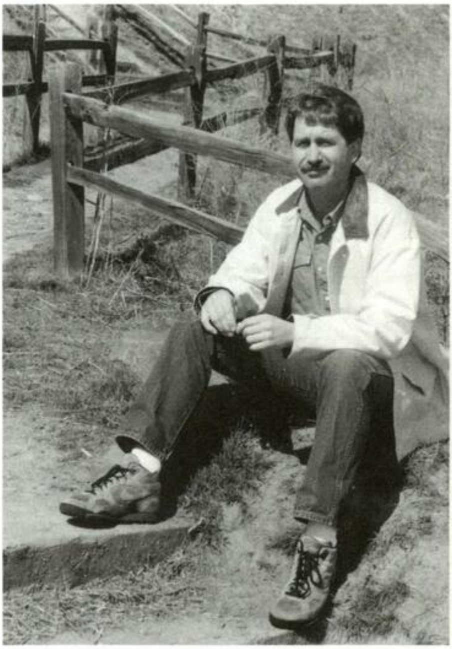
Understandably, metric rifle calibers have not been as successful in the U.S. as in the rest of the world. With the exception of the various 7mm cartridges, they have been slow sellers compared to more "traditional" cartridges. Thus, it was a bit of a surprise when Remington announced the 8mm Remington Magnum in 1977. At a time when short magnums such as the 300 Winchester Magnum were the rage, the 8mm Remington was designed on the full-length 300 H&H case. The result was a case with a large powder capacity—not much less than the powerful 340 Weatherby Magnum. Factory ammunition is made by Remington in two bullet weights: 185 and 220 grains.

Remington's position in marketing the 8mm Magnum was to provide "...optimum characteristics of flat shooting and high energy without developing excessively uncomfortable recoil." Most rifleman familiar with the big cartridge will readily agree with the first part of the quote but may challenge the last phrase! In spite of its heavy recoil, the 8mm Remington lives up to the promise of hard-hitting power at long ranges.

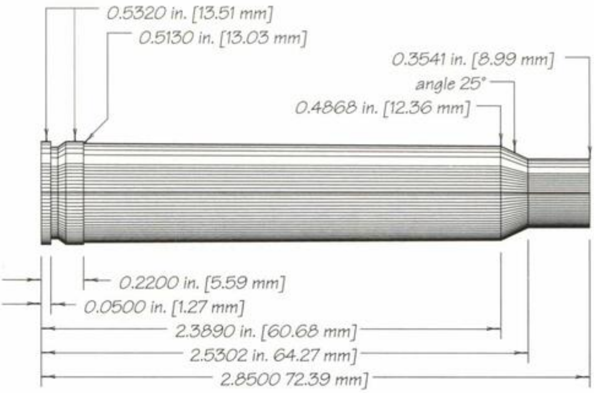
This cartridge is really too much for most North American game (other than the large bears) but would do well for long shots on elk. It has been used with very good results on the African plains, where long shots on tough animals like kudu are common. Before choosing the 8mm Magnum for African hunting, check the game regulations in the area you plan to hunt. Some countries have bore size restrictions.

The Speer 200 grain Hot-Cor spitzer was designed specifically for the 8mm Magnum. Its tough construction and relatively high ballistic coefficient are a perfect match for the cartridge's performance characteristics. The lighter 150 and 170 grain Speer bullets can be used for reduced-recoil practice, but as they were designed for lower velocity cartridges we don't recommend them for heavy game

The SAAMI maximum average pressure for the 8mm Remington Magnum is 54,000 cup. These loads do not exceed that limit.

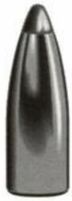


Joe Verbanac, CCI/Speer Art Director.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.3541 in. [8.99 mm]
angle 25°
0.4868 in. [12.36 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.3890 in. [60.68 mm]
2.5302 in. 64.27 mm]
2.8500 72.39 mm]

Max. Case Length: 2.850"
Trim-to Length: 2.840"
Max. Cart. Length: 3.600"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

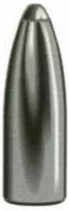
Test Firearm: Remington Model 700
Case: R-P
Primers: CCI 250



.323" Dia. **150 Grain** Sect. Density .205	**8mm Spitz-SP**					
Ballistic Coefficient	0.369					
C.O.L. Tested At	3.575"					
Speer Part No.	2277					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**86.0C**	**3436**	760*	**80.0**	**3225**	IMR 3031*	**67.0**	**3149**
	80.0	3194		76.0	3076		63.0	2969
H450*	**87.0C**	**3329**	H380*	**76.0**	**3214**	IMR 4895*	**66.0**	**3134**
	83.0	3148		72.0	3038		62.0	2955
IMR 4350*	**81.0**	**3322**	H414*	**78.0**	**3191**	Reduced Load IMR 4198*	**32.0**	**2002**
	77.0	3158		74.0	3025		28.0	1763

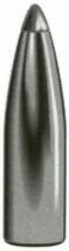
Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.323" Dia.
170 Grain
Sect. Density .232

	8mm SSpitz-SP					
Ballistic Coefficient	0.354					
C.O.L. Tested At	3.575"					
Speer Part No.	2283					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H450*	**83.0**	**3140**	**H380***	**71.0**	**3000**	**IMR 4064***	**66.0**	**2940**
	79.0	2981		67.0	2828		62.0	2761
IMR 4831*	**80.0**	**3114**	**H414***	**73.0**	**2970**	**IMR 4895***	**63.0**	**2919**
	74.0	2896		69.0	2817		59.0	2740
IMR 4350*	**77.0**	**3078**	**760***	**74.0**	**2965**	Reduced Load **IMR 4198***	**34.0**	**2042**
	73.0	2902		70.0	2795		30.0	1790



.323" Dia.
200 Grain
Sect. Density .274

	8mm Spitz-SP					
Ballistic Coefficient	0.411					
C.O.L. Tested At	3.575"					
Speer Part No.	2285					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4831*	**78.0**	**2996**	**IMR 4064***	**64.0**	**2803**	**IMR 4320***	**62.0**	**2717**
	72.0	2763		60.0	2638		58.0	2544
IMR 7828*	**83.0C**	**2938**	**IMR 4895***	**61.0**	**2736**	Reduced Load **IMR 4198***	**36.0**	**2025**
	79.0	2712		57.0	2564		32.0	1803
IMR 4350*	**74.0**	**2936**	**IMR 3031***	**61.0**	**2732**			
	70.0	2770		57.0	2561			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

338-06

Interest in necking up the 30-06 case to hold larger diameter bullets goes back to the 1920's when the 35 Whelen was developed. Around 1945, Charles O'Neil, Elmer Keith and Don Hopkins collaborated to develop the 333 OKH. This cartridge used the 30-06 case necked up to hold bullets designed for the 333 Jeffery, a proprietary English cartridge. The wildcat OKH cartridge proved successful on all types of North American game. The heavy bullets at moderate velocity gave tremendous penetration for reliable kills. The only disadvantage was that .333" bullets were usually in short supply and weight selection was limited.

When the 338 Winchester Magnum was introduced in 1958, American bullet makers like Speer introduced a wide variety of .338" bullets for handloading. Shooters who wanted a 333 OKH but were put off by the bullet problem quickly found an alternative in the 338-06.

The 338-06 is a very flexible cartridge. With lighter bullets, it is an excellent deer cartridge which kills cleanly and damages much less meat than any of the 300 magnums. Loaded with the 250 grain Speer Grand Slam, the cartridge is ready for elk and moose. For large bears, the 275 grain semi-spitzer will give deep penetration and break bone structures.

Ballistically, the 338-06 is somewhat superior to the 35 Whelen. In the Whelen, 250 grain bullets failed to reach 2400 feet/sec. In the 338-06, the same weight bullets approached 2500 feet/sec and exceeded this mark with one propellant. Velocities with the 200 grain spitzer were in excess of 2700 feet/sec, only about 200 feet/sec behind the same bullet in the 338 Winchester Magnum.

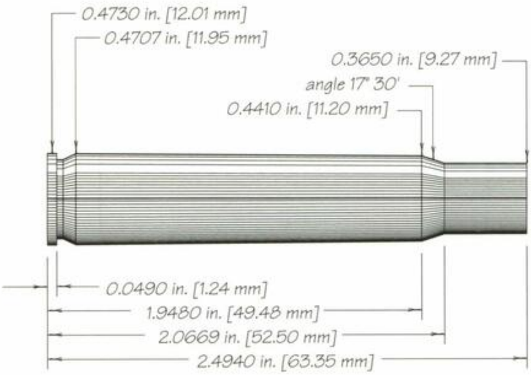
The fact that .338" bullets have higher ballistic coefficients than .358" bullets of the same weight, and that heavier and tougher bullets are available for the 338, combine to make the 338-06 superior to the Whelen for the rifleman who commonly hunts large game like moose, elk and bear.

It is too bad that the 338-06 hasn't been commercialized because it is one of the nicest medium caliber rifle cartridges on the scene, and is better suited for most North American hunting than the 8mm Remington Magnum or the 338 Winchester Magnum.

Because this is a wildcat cartridge, no pressure standards exist. The loads listed are in the pressure range of the 35 Whelen, around 52,000 cup and were safe in our test rifle. Since all chambers are custom and not very consistent, always start with the minimum load and work up slowly, watching for pressure signs in your rifle.

Editor's Note: Our special thanks to Steve Comus, editor of Gun World magazine, for the kind loan of his fine custom A-Square™ rifle built by Art Alpin on a 1917 Enfield action.

Steve Comus, Gun World Editor, loaned Speer his custom A-Square 338-06 for data developement.


0.4730 in. [12.01 mm]
0.4707 in. [11.95 mm]
0.3650 in. [9.27 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.0669 in. [52.50 mm]
2.4940 in. [63.35 mm]

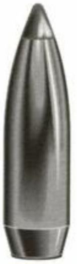
Max. Case Length: 2.494"
Trim-to Length: 2.484"
Max. Cart. Length: 3.340"
RCBS Shellholder: #3
Barrel Length: 23"
Twist: 1-10"

Test Firearm: A-Square "Hamilcar" (Custom Enfield)
Case: R-P 35 Whelen (Reformed)
Primers: CCI 200

.338" Dia. **200 Grain** Sect. Density .254	**338** **Spitz-SP**					
Ballistic Coefficient	0.448					
C.O.L. Tested At	3.340"					
Speer Part No.	2405					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350	**63.0C**	**2773**	**Re15**	**55.0**	**2752**	**760**	**62.5C**	**2740**
	59.0	2602		51.0	2552		58.5	2563
IMR 4064	**56.0**	**2766**	**Viht. N150**	**56.5**	**2752**	**IMR 4350**	**62.0C**	**2736**
	52.0	2568		52.5	2558		58.0	2560
IMR 4320	**56.5**	**2759**	**H380**	**62.0C**	**2750**	**AA 4350**	**64.5C**	**2733**
	52.5	2564		58.0	2573		60.5	2564

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

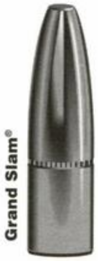


.338" Dia.
225 Grain

Sect. Density .281

	338 BT Spitz-SP					
Ballistic Coefficient	0.484					
C.O.L. Tested At	3.340"					
Speer Part No.	2406					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**64.5C**	**2678**	**IMR 4350**	**61.0C**	**2655**	**Viht. N150**	**54.0**	**2588**
	60.5	2512		57.0	2482		50.0	2396
Viht. N160	**63.5C**	**2675**	**760**	**61.0**	**2650**	**AA 4350**	**60.0C**	**2566**
	59.5	2507		57.0	2476		56.0	2309
H4350	**62.0C**	**2671**	**IMR 4320**	**54.5**	**2610**	**IMR 4831**	**61.0C**	**2557**
	58.0	2499		50.5	2418		57.0	2389
Re15	**54.5**	**2656**	**IMR 4064**	**53.0**	**2591**	**AA 3100**	**63.0C**	**2547**
	50.5	2462		49.0	2395		59.0	2385



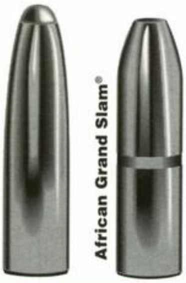
.338" Dia.
250 Grain

Sect. Density .313

	338 GS-SP					
Ballistic Coefficient	0.431					
C.O.L. Tested At	3.285"					
Speer Part No.	2408					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**61.0C**	**2531**	**IMR 4831**	**59.5C**	**2478**	**IMR 4064**	**50.5**	**2411**
	57.0	2366		55.5	2311		46.5	2220
H4831	**61.5C**	**2492**	**Viht. N160**	**58.0**	**2473**	**Re15**	**50.0**	**2409**
	57.5	2330		54.0	2256		46.0	2216
IMR 4350	**57.5**	**2491**	**760**	**56.5**	**2468**	**AA 3100**	**60.0C**	**2408**
	53.5	2318		52.5	2294		56.0	2247
H4350	**58.0C**	**2489**	**H414**	**57.0**	**2467**	**IMR 4320**	**51.0**	**2403**
	54.0	2317		53.0	2293		47.0	2215

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.338" Dia.
275 Grain
Sect. Density .348

	338 SSpitz-SP	338 AGS-S				
Ballistic Coefficient	0.456	0.291				
C.O.L. Tested At	3.340"	3.195"				
Speer Part No.	2411	2414				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19	**59.0**	**2394**	**IMR 4064**	**49.5**	**2314**	**H450**	**58.0**	**2280**
	55.0	2232		45.5	2127		54.0	2123
AA 3100	**59.5C**	**2351**	**IMR 4350**	**54.0**	**2314**	**IMR 4831**	**56.0**	**2259**
	55.5	2193		50.0	2143		52.0	2098
Re22	**59.5C**	**2351**	**IMR 4320**	**50.0**	**2295**	**IMR 7828**	**58.0C**	**2209**
	55.5	2193		46.0	2111		54.0	2057
Viht. N160	**56.6**	**2319**	**H4831**	**59.0C**	**2294**			
	52.6	2155		55.0	2139			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

338 WINCHESTER MAGNUM

Winchester announced two new short magnums in 1958—the 264 and the 338 Winchester Magnums. Of the two, the 338 has been the most successful because it filled a big performance gap between the various 300 magnums and the 375 H&H Magnum. Intended for the largest North American game, the 338 has proved its effectiveness on grizzly and brown bear and gives excellent performance on the larger species of African plains game in regions permitting this bore diameter.

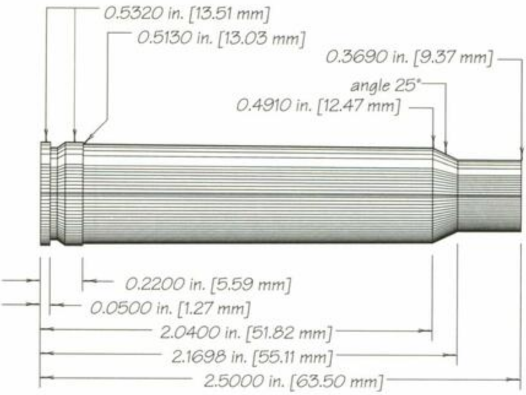
Because the 338 functions in standard length actions, it is now chambered by most rifle makers. Factory ammunition has been loaded with 200, 250 and 300 grain bullets. Almost any bullet can achieve 4000 foot-pounds of muzzle energy in the 338, really making it more gun than most North American game requires. However, it has become popular in the West as an elk rifle where its high retained energy gives it an advantage over the 300 magnums.

For large deer and elk, Speer's 200 grain Hot-Cor and 225 boat tail are both good choices. Their high ballistic coefficients give flat trajectories for long shots. For large bears, the 250 grain Grand Slam and the 275 grain semi-spitzer are the best choice. The African Grand Slam Tungsten Core Solid is available for maximum, straight-line penetration.

If the owner of a 270 or 30-06 rifle wants to move up to a more powerful cartridge to extend the number of species he can hunt, the 338 is a good choice. The 300 Magnums are borderline performers on large bear and the 270 and 30-06 are more than adequate for most lesser species. With the exception of the 8mm Remington Magnum, Speer feels the .338" bore is the smallest that the serious bear hunter should consider. We are aware that many bear are killed with smaller rifles but many are wounded, too. The 338 caliber allows the use of heavy, tough bullets on the big bruins.

Like other belted magnums, we recommend that you set your loading dies so that the case headspaces on the shoulder, not the belt. The RCBS Precision Mic is available in 338 Winchester Magnum for precisely adjusting your dies for a custom fit in the chamber. This will improve case life and accuracy and reduce the chance of a head separation.

The following loads do not exceed the 54,000 cup pressure limit of the 338 Winchester.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.3690 in. [9.37 mm]
angle 25°
0.4910 in. [12.47 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.0400 in. [51.82 mm]
2.1698 in. [55.11 mm]
2.5000 in. [63.50 mm]

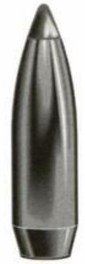
Max. Case Length: 2.500"
Trim-to Length: 2.490"
Max. Cart. Length: 3.340"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-10"

Test Firearm: Winchester Model 70
Case: W-W
Primers: CCI 250

.338" Dia. **200 Grain** Sect. Density .250	338 Spitz-SP					
Ballistic Coefficient	0.448					
C.O.L. Tested At	3.300"					
Speer Part No.	2405					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H4350*	**75.0C**	**2932**	**AA 3100***	**77.0C**	**2823**	**H414***	**70.0**	**2773**
	71.0	2697		73.0	2654		66.0	2579
H450*	**78.0C**	**2911**	**760***	**70.0**	**2816**	**AA 2700***	**69.0**	**2757**
	74.0	2707		66.0	2604		65.0	2550
IMR 7828*	**81.0**	**2882**	**IMR 4350***	**72.0**	**2809**	**IMR 3031***	**59.0**	**2627**
	77.0	2682		68.0	2626		55.0	2469
IMR 4831*	**75.5**	**2868**	**Re19***	**76.0C**	**2806**	**IMR 4064***	**61.0**	**2610**
	71.5	2640		72.0	2596		57.0	2440
Viht. N150*	**65.0**	**2824**	**H4831***	**77.0C**	**2784**	Reduced Load **SR 4759***	**29.0**	**1866**
	61.0	2598		73.0	2603		25.0	1600

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.338" Dia. 225 Grain

Sect. Density .281

	338 BT Spitz-SP					
Ballistic Coefficient	0.484					
C.O.L. Tested At	3.340"					
Speer Part No.	2406					

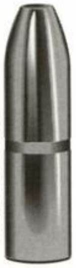
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**75.0C**	**2981**	AA 2700*	**72.0**	**2855**	IMR 7828*	**75.0C**	**2671**
	71.0	2805		68.0	2700		71.0	2420
Re19*	**78.0C**	**2944**	AA 3100*	**77.0C**	**2807**	Viht. N165*	**74.0C**	**2670**
	74.0	2791		73.0	2653		70.0	2496
760*	**74.0**	**2944**	H4831*	**77.0C**	**2800**	H1000*	**78.0C**	**2582**
	70.0	2787		73.0	2657		74.0	2437
H4350*	**75.0C**	**2898**	H450*	**75.0C**	**2773**			
	71.0	2739		71.0	2654			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.338" Dia. **250 Grain** Sect. Density .313	338 GS-SP					
Ballistic Coefficient	0.431					
C.O.L. Tested At	3.300"					
Speer Part No.	2408					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re19*	**72.0C**	**2664**	**IMR 4831***	**71.0**	**2635**	**H1000***	**77.0C**	**2545**
	68.0	2478		67.0	2477		73.0	2380
IMR 4350*	**69.0**	**2655**	**H450***	**73.0C**	**2620**	**AA 2700***	**65.0**	**2526**
	65.0	2509		69.0	2463		61.0	2394
Re22*	**73.0C**	**2653**	**AA 3100***	**73.0C**	**2616**	**H4831***	**71.0C**	**2497**
	69.0	2441		69.0	2472		67.0	2297
IMR 7828*	**75.0**	**2652**	**H4350***	**68.0C**	**2581**	**760***	**64.0**	**2458**
	71.0	2480		64.0	2387		60.0	2286
Viht. N165*	**74.0C**	**2637**	**H414***	**66.0**	**2548**	Reduced Load **SR 4759***	**32.0**	**1856**
	70.0	2439		62.0	2357		28.0	1638

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



African Grand Slam® Tungsten Solid

.338" Dia. **275 Grain** Sect. Density .344	**338 AGS-S**					
Ballistic Coefficient	0.291					
C.O.L. Tested At	3.200"					
Speer Part No.	2414					

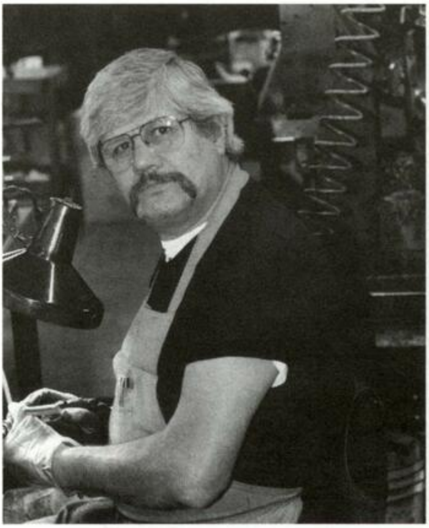
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 4350*	**72.0C**	**2576**	**760***	**67.0**	**2538**	**AA 2700***	**65.0**	**2473**
	68.0	2427		63.0	2381		61.0	2321
Re19*	**72.0C**	**2564**	**IMR 7828***	**74.0C**	**2519**	**H1000***	**78.0C**	**2472**
	68.0	2427		70.0	2369		74.0	2352
H414*	**67.0**	**2558**	**IMR 4350***	**67.0C**	**2488**	**Viht. N165***	**71.0C**	**2470**
	63.0	2449		63.0	2339		67.0	2309
H4350*	**70.0C**	**2544**	**AA 3100***	**72.0C**	**2488**	**H4831***	**69.0C**	**2350**
	66.0	2403		68.0	2334		65.0	2224

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.338" Dia. **275 Grain** Sect. Density .348	**338** **SSpitz-SP**					
Ballistic Coefficient	0.456					
C.O.L. Tested At	3.340"					
Speer Part No.	2411					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 4350*	**72.0C**	**2631**	**H4350***	**69.0**	**2505**	**H414***	**64.0**	**2445**
	68.0	2481		65.0	2400		60.0	2307
IMR 7828*	**75.0C**	**2598**	**IMR 4350***	**66.0C**	**2499**	**760***	**64.0**	**2444**
	71.0	2451		62.0	2314		60.0	2317
Re19*	**70.0**	**2554**	**AA 3100***	**72.0C**	**2492**	**H450***	**71.0**	**2409**
	66.0	2387		68.0	2357		67.0	2315
H1000*	**78.0C**	**2548**	**H4831***	**70.0C**	**2467**	Reduced Load **SR 4759***	**34.0**	**1808**
	74.0	2430		66.0	2326		30.0	1587
IMR 4831*	**70.0C**	**2541**	**AA 2700***	**65.0**	**2460**			
	66.0	2394		61.0	2355			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Juan Flores, RCBS Carbide Die Line.

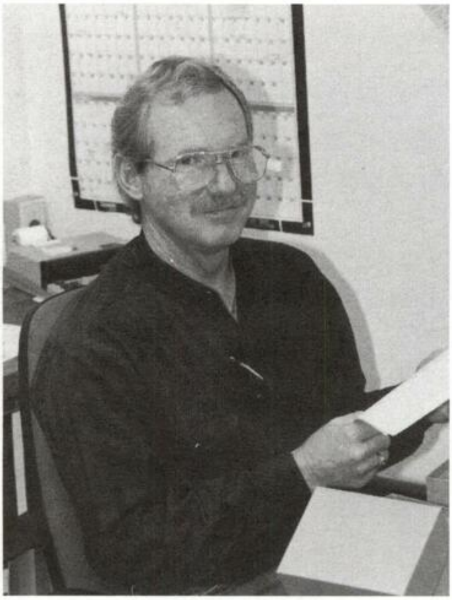
340 WEATHERBY MAGNUM

The 340 Weatherby was introduced in 1962 to fill the gap between the 300 Weatherby and the massive 378 Weatherby cartridge. Part of the drive to bring out this cartridge was the quick acceptance of the 338 Winchester Magnum by American shooters. Like the 300 Weatherby, the 340 is based on the full-length H&H case, thus requiring that rifles have a long action.

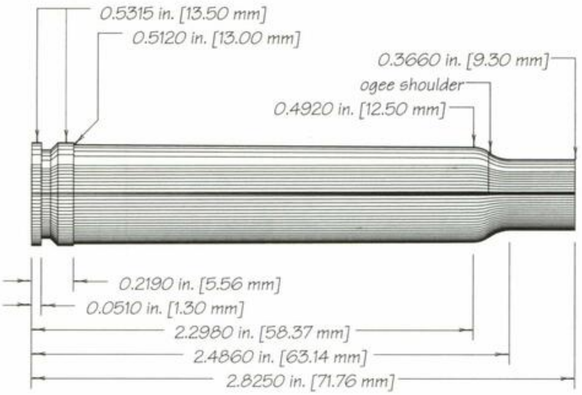
In spite of the larger case, the 340 Weatherby has an velocity advantage of only about 100 feet/sec over the 338 Winchester. The choice between the two can be made largely on the shooter's preference of rifle manufacturer. The 340 can be used on the same types of game as the 338 Winchester. Although factory cases may be hard to find, they can be easily made from 300 Weatherby cases or, with a bit more work, from 300 H&H brass.

For Alaskan or thinned-skinned African game, the 340 Weatherby is an excellent cartridge. Recoil seems to be more noticeable than with the 338 Winchester, largely due to the heavier charge weights required in the Weatherby.

No industry pressure standards exist for most of the Weatherby cartridges, but these data were completely safe in the test rifle.



John Snipes, RCBS Die Line Supervisor.


0.5315 in. [13.50 mm]
0.5120 in. [13.00 mm]
0.3660 in. [9.30 mm]
ogee shoulder
0.4920 in. [12.50 mm]
0.2190 in. [5.56 mm]
0.0510 in. [1.30 mm]
2.2980 in. [58.37 mm]
2.4860 in. [63.14 mm]
2.8250 in. [71.76 mm]

Max. Case Length: 2.820"
Trim-to Length: 2.810"
Max. Cart. Length: 3.675"
RCBS Shellholder: #4
Barrel Length: 26"
Twist: 1-10"

Test Firearm: Weatherby Mark V
Case: Weatherby
Primers: CCI 250

.338" Dia. **200 Grain** Sect. Density .254	**338** **Spitz-SP**					
Ballistic Coefficient	0.448					
C.O.L. Tested At	3.560"					
Speer Part No.	2405					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**94.0**	**3048**	**IMR 4831***	**83.0**	**2976**	**H380***	**75.0**	**2806**
	90.0	2941		79.0	2803		71.0	2668
IMR 4350*	**82.0**	**3010**	**IMR 4064***	**73.0**	**2909**	**760***	**76.0**	**2801**
	78.0	2816		69.0	2721		72.0	2699
IMR 4320*	**74.0**	**3009**	**H450***	**85.0**	**2892**	Reduced Load **SR 4759***	**33.0**	**1970**
	70.0	2849		81.0	2774		29.0	1737

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.338" Dia. **250 Grain** Sect. Density .313	**338** **GS-SP**					
Ballistic Coefficient	0.431					
C.O.L. Tested At	3.560"					
Speer Part No.	2408					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 7828*	**90.0**	**2862**	**IMR 4064***	**71.0**	**2698**	**H450***	**79.0**	**2620**
	86.0	2713		67.0	2489		75.0	2414
IMR 4831*	**80.0**	**2766**	**H380***	**73.0**	**2669**	**AA 8700***	**91.0**	**2511**
	76.0	2581		69.0	2492		87.0	2407
IMR 4350*	**77.0**	**2729**	**760***	**74.0**	**2668**			
	73.0	2563		70.0	2473			

African Grand Slam®

.338" Dia. **275 Grain** Sect. Density .348	**338** **SSpitz-SP**	**338 AGS** **Solid**				
Ballistic Coefficient	0.456	0.291				
C.O.L. Tested At	3.560"	3.520"				
Speer Part No.	2411	2414				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
7828*	**88.0**	**2748**	**IMR 4064***	**69.0**	**2591**	**760***	**72.0**	**2471**
	84.0	2601		65.0	2438		68.0	2406
IMR 4831*	**78.0**	**2674**	**H380***	**71.0**	**2515**	Reduced Load **SR 4759***	**39.0**	**1905**
	74.0	2521		67.0	2311		35.0	1686
IMR 4350*	**76.0**	**2645**	**H450***	**77.0**	**2508**			
	72.0	2481		73.0	2389			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

357 MAGNUM (Rifle)

Although developed as a handgun cartridge, the 357 Magnum is seeing increased use as a rifle cartridge. It is simply a modern version of the old concept of having a rifle and sidearm use the same cartridge. In the latter part of the 19th Century, Winchester and Colt sold quite a few 32-20, 38-40 and 44-40 rifles and revolvers to shooters who found this idea important.

Not long after the 357 was introduced, custom gunsmiths started converting Model 1892 Winchesters to fire the new cartridge. In 1979, Marlin reintroduced its classic 1894 carbine as the Model 94, chambered for the 357 Magnum. Rossi and Browning have produced Winchester Model 92 replicas in this caliber and Ruger made a limited production run of 357 Magnum No. 1 single-shot rifles a few years ago.

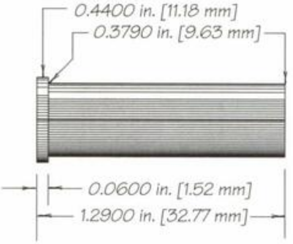
As a rifle cartridge, the 357 has worked reasonably well within its limits. Although their trajectory isn't as flat as a high-speed 32-20, the heavier .357" bullets deliver more energy. It is nearly as powerful as the obsolete 351 Winchester self-loader cartridge. With 125 grain hollow points, the 357 is effective on varmints out to 100 yards. The 357 carbine can also be used for small whitetail deer with heavier bullets if the range is under 100 yards.

For deer hunting, we recommend the 158 grain jacketed soft point. Hollow point bullets, designed for optimum expansion in the 1000-1300 foot/sec velocity range, can cause shallow wounds on deer at rifle velocities.

Rifle loads for the 357 Magnum are held to the normal industry pressure of 35,000 psi.

Special Notes
357 Magnum Rifles:

- Never attempt to use any pointed or full-jacketed bullets in lever-action rifles with tubular magazines.
- All lever-action 357 Magnum rifles have bolts which lock at the rear. This allows the bolt to spring slightly during firing, stretching the case. Use only new or once-fired cases for maximum loads.
- DO NOT USE LOADS LESS THAN THE MINIMUM CHARGES SHOWN. SMALL CHARGES OF POWDER MAY NOT BE SUFFICIENT TO PUSH A JACKETED BULLET DOWN AN 18 INCH BARREL AND A DANGEROUS BORE OBSTRUCTION MAY RESULT.



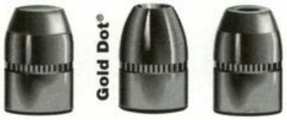
Max. Case Length: 1.290"
Trim-to Length: 1.280"
Max. Cart. Length: 1.590"
RCBS Shellholder: #6
Barrel Length: 18"
Twist: 1-16"

Test Firearm: Marlin M1894
Case: Speer
Primers: CCI 500, 550
Comments: Carefully read all text for this cartridge.

.357" Dia. **110 Grain** Sect. Density .123	**38 JHP**					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.575"					
Speer Part No.	4007					

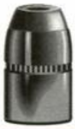
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**21.0C**	**2467**	**296***	**23.0C**	**2321**	**HS-7***	**14.4**	**1926**
	19.0	2331		21.0	2131		12.5	1703
H110*	**23.0C**	**2353**	**Blue Dot**	**16.0**	**2317**	**2400***	**15.0**	**1791**
	21.0	2218		14.0	2188		13.0	1443

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



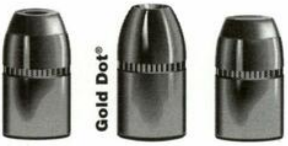
.357" Dia. **125 Grain** Sect. Density .140	**38** **JSP**	**38** **GDHP**	**38** **JHP**			
Ballistic Coefficient	0.140	0.140	0.135			
C.O.L. Tested At	1.575"	1.580"	1.575"			
Speer Part No.	4011	4012	4013			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**18.8C**	**2197**	**296***	**20.3C**	**2125**	**AA #7***	**13.5**	**1770**
	16.8	1993		18.3	1938		12.0	1588
H110*	**20.0C**	**2125**	**Blue Dot**	**13.0**	**1916**	**2400***	**14.3**	**1751**
	18.0	1923		11.5	1729		12.5	1477



.357" Dia. **140 Grain** Sect. Density .157	**38** **JHP**					
Ballistic Coefficient	0.152					
C.O.L. Tested At	1.590"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**17.0C**	**1969**	**IMR 4227**	**19.2C**	**1882**	**Blue Dot**	**11.5**	**1670**
	15.0	1743		17.2	1672		10.3	1477
H110*	**18.0**	**1900**	**296***	**18.0**	**1859**	**2400***	**13.0**	**1523**
	16.0	1718		16.0	1693		11.7	1295



.357" Dia. **158 Grain** Sect. Density .177	**38** **JHP**	**38** **GDHP**	**38** **JSP**			
Ballistic Coefficient	0.158	0.168	0.150			
C.O.L. Tested At	1.570"	1.575"	1.570"			
Speer Part No.	4211	4215	4217			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**15.0**	**1738**	**IMR 4227**	**17.0C**	**1588**	**AA #9**	**13.7**	**1551**
	13.5	1564		15.0	1397		12.3	1353
H110*	**15.5**	**1648**	**296***	**14.7**	**1564**	**Blue Dot**	**10.2**	**1426**
	13.9	1473		13.2	1341		9.0	1265

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

35 REMINGTON (Rifle)

At one time, Remington had a series of rimless rifle cartridges designed for the various semi-auto and slide-action rifles that they manufactured. The 25, 30, 32 and 35 Remington cartridges were reasonably popular in the first half of this century. Today all are obsolete except the 35 caliber version. The 35 Remington case is unusual in that it uses a non-standard head size of .457", about .013" smaller than the 30-06, yet larger than the three obsolete Remington cartridges.

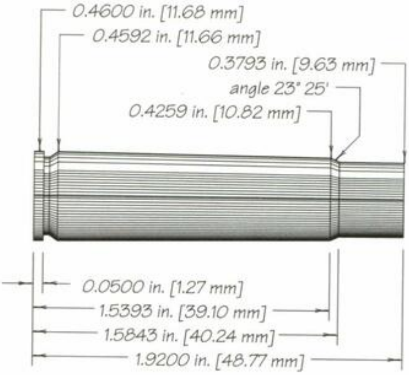
The continued popularity of the 35 Remington is due to its excellent reputation as a short-range woods cartridge for deer and black bear. Usually chambered in light, handy carbines, the 35 Remington is a better cartridge than the 30-30. Although the "paper" ballistics show little difference, the 35 Remington handles heavier bullets for deeper penetration. Even today, the Eastern woods hunter who doesn't take shots beyond 150 yards would be hard-pressed to improve the performance.

Over the years, many different rifles were offered in 35 Remington. Today the only survivor is Marlin's Model 336 lever-action carbine. Factory ammunition is loaded with a 150 grain spitzer and a 200 grain round nose bullet. The 150 grain factory load gained a poor reputation for accuracy and game performance and should be avoided.

Handloading greatly extends the usefulness of the cartridge. Pistol bullets can be used for varmints at moderate ranges and Speer's 180 and 220 grain Hot-Cor bullets, designed for the 35 Remington, offer better performance than the 200 grain factory loads. Although the 35 Remington operates at modest pressures, the reloader should keep an eye out for incipient case head separations in lever guns.

We are often asked if the Speer 250 grain spitzer and Grand Slam bullet can be loaded in the 35 Remington. We don't recommend them because these bullets were designed for higher velocities. FLAT POINT BULLETS MUST BE USED IN RIFLES HAVING TUBULAR MAGAZINES. SPITZER AND TMJ SILHOUETTE BULLETS CAN CAUSE CARTRIDGES TO EXPLODE IN THE MAGAZINE WITH THE RISK OF GUN DAMAGE AND PERSONAL INJURY.

The 35 Remington is seeing renewed interest among handgunners. See the Handgun Data section for loading information for the Thompson/Center Contender pistol. The industry working pressure for the 35 Remington is 35,000 cup.


0.4600 in. [11.68 mm]
0.4592 in. [11.66 mm]
0.3793 in. [9.63 mm]
angle 23° 25'
0.4259 in. [10.82 mm]
0.0500 in. [1.27 mm]
1.5393 in. [39.10 mm]
1.5843 in. [40.24 mm]
1.9200 in. [48.77 mm]

Max. Case Length: 1.920"
Trim-to Length: 1.910"
Max. Cart. Length: 2.525"
RCBS Shellholder: #9
Barrel Length: 20"
Twist: 1-16"

Test Firearm: Marlin 336
Case: W-W
Primers: CCI 200, 250

.357" Dia. **158 Grain** Sect. Density .177	**38 JHP**	**38 JSP**				
Ballistic Coefficient	0.158	0.150				
C.O.L. Tested At	2.220"	2.220"				
Speer Part No.	4211	4217				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**39.0**	**2185**	**IMR 3031**	**37.0**	**2141**	**Re7**	**37.0**	**2357**
	35.0	1932		33.0	1896		33.0	2091

Notes: Bold print denotes maximum loads. They should be used with caution.

.358" Dia. 180 Grain Sect. Density .201	35 Flat-SP				
Ballistic Coefficient	0.245				
C.O.L. Tested At	2.470"				
Speer Part No.	2435				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**44.0C**	**2224**	748*	**42.0**	**2072**	H380*	**44.0**	**2023**
	40.0	1967		38.0	1858		40.0	1807
H335*	**38.0**	**2224**	IMR 4895	**38.0**	**2055**	IMR 4320	**36.0**	**1983**
	34.0	1954		34.0	1811		32.0	1729
AA 2015BR	**36.0**	**2138**	Viht. N133	**35.0**	**2054**	Re7	**30.0**	**1967**
	32.0	1937		31.0	1852		26.0	1679
BL-C(2)*	**35.0**	**2097**	H414*	**47.0**	**2041**	Reduced Load SR 4759	**20.0**	**1653**
	31.0	1831		43.0	1847		18.0	1499

.358" Dia. 220 Grain Sect. Density .245	35 Flat-SP				
Ballistic Coefficient	0.316				
C.O.L. Tested At	2.470"				
Speer Part No.	2439				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**39.0C**	**1922**	748*	**35.0**	**1830**	H335*	**32.0**	**1784**
	35.0	1721		31.0	1674		28.0	1476
AA 2015BR	**33.0**	**1901**	Viht. N133	**31.0**	**1807**	IMR 3031	**33.5**	**1781**
	29.0	1665		27.0	1594		29.5	1531
IMR 4064	**36.0**	**1840**	BL-C(2)*	**35.0**	**1794**	IMR 4320	**33.0**	**1692**
	32.0	1641		31.0	1557		29.0	1502
H414*	**40.0**	**1831**	IMR 4895	**35.5**	**1789**	Re7	**24.5**	**1536**
	36.0	1656		31.5	1640		20.5	1173

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

350 REMINGTON MAGNUM

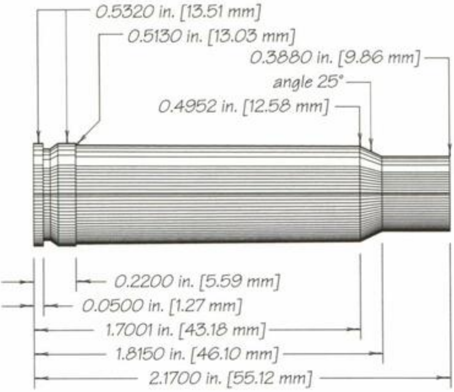
The 350 Remington Magnum is a companion cartridge to the 6.5mm Remington Magnum. Both were introduced in the mid-1960's in the Model 660 bolt-action carbine. The very short action of these rifles requires a minimum cartridge length, so the 350 Remington is about a half-inch shorter than the usual "short magnums" such as the 300 Winchester.

Factory ammunition fires a 200 grain bullet at 2600 feet/sec. The handloader can load the cartridge with greater flexibility because there are a number of component bullets available in other weights. When handloading, special attention to bullet seating depth is required. The heavier bullets must be seated with the base well below the neck of the cartridge, thus restricting powder capacity.

The 350 Remington is similar in performance to the 35 Whelen cartridge. For deer, the 180 grain Speer Hot-Cor flat point is a very good performer. Some powders were able to drive this bullet up to 2900 feet/sec. The 220 grain flat point is the bullet we recommend for elk and moose. The 350 Magnum can be used on large bear if the 250 grain Grand Slam or spitzer bullet is used. Some elk hunters prefer the 250 grain spitzer to the 220 flat point because of its more aerodynamic shape. We have also listed loads for Speer's 158 grain JHP revolver bullet. This can be used effectively on varmints or for low-cost plinking but, at rifle velocities, it is too explosive for game.

Remington and Ruger have produced rifles for the 350 Magnum; however, neither firm currently catalogs them. With no new rifles on the market and the popularity of the 35 Whelen, the 350 Remington Magnum appears to be headed for obsolescence. The industry maximum pressure for this cartridge is 53,000 cup. These loads are within those guidelines.

Jeannie Riley, RCBS Customer Service Rep.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.3880 in. [9.86 mm]
angle 25°
0.4952 in. [12.58 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
1.7001 in. [43.18 mm]
1.8150 in. [46.10 mm]
2.1700 in. [55.12 mm]

Max. Case Length: 2.170"
Trim-to Length: 2.160"
Max. Cart. Length: 2.800"
RCBS Shellholder: #4
Barrel Length: 22"
Twist: 1-16"

Test Firearm: Ruger 77
Case: R-P
Primers: CCI 200, 250

.357" Dia. **158 Grain** Sect. Density .177	**38** **JHP**	**38** **JSP**				
Ballistic Coefficient	0.158	0.150				
C.O.L. Tested At	2.470"	2.470"				
Speer Part No.	4211	4217				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**55.0**	**2901**	**IMR 3031**	**58.0**	**2865**	**IMR 4064**	**62.0**	**2841**
	51.0	2656		54.0	2462		58.0	2454

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.358" Dia. **180 Grain** Sect. Density .201	**35** **Flat-SP**					
Ballistic Coefficient	0.245					
C.O.L. Tested At	2.800"					
Speer Part No.	2435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**60.0**	**2942**	**IMR 4320**	**61.0C**	**2788**	**Re7**	**51.0**	**2574**
	56.0	2696		57.0	2600		47.0	2329
IMR 4064	**62.0C**	**2914**	**748***	**62.0**	**2679**	**760***	**65.0C**	**2422**
	58.0	2720		58.0	2461		61.0	2206
IMR 4895	**60.0**	**2900**	**H380***	**62.0C**	**2635**	Reduced Load **SR 4759**	**28.0**	**1926**
	56.0	2699		58.0	2461		24.0	1650

.358" Dia. **220 Grain** Sect. Density .245	**35** **Flat-SP**					
Ballistic Coefficient	0.316					
C.O.L. Tested At	2.740"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)*	**60.0**	**2676**	**IMR 3031**	**59.0**	**2642**	**H380***	**62.0C**	**2496**
	56.0	2496		55.0	2451		58.0	2407
748*	**62.0**	**2664**	**IMR 4320**	**60.0C**	**2629**	**760**	**65.0C**	**2471**
	58.0	2489		56.0	2447		61.0	2301
IMR 4895	**60.0**	**2655**	**H322**	**55.0C**	**2563**	**Re7**	**49.8**	**2426**
	56.0	2525		51.0	2428		45.8	2240

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.358" Dia. **250 Grain** Sect. Density .279	**35** **Spitz-SP**	**35** **GS-SP**				
Ballistic Coefficient	0.355	0.446				
C.O.L. Tested At	2.800"	2.800"				
Speer Part No.	2453	2455				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**57.0C**	**2484**	**IMR 4064**	**55.0C**	**2348**	**IMR 4320**	**54.0C**	**2219**
	53.0	2266		51.0	2170		50.0	2053
IMR 3031	**52.0C**	**2382**	**760***	**58.0C**	**2294**	**H380***	**58.0C**	**2170**
	48.0	2188		54.0	2116		54.0	2018
IMR 4895	**53.0C**	**2353**	**BL-C(2)***	**52.0**	**2257**	Reduced Load **SR 4759**	**30.0**	**1800**
	49.0	2159		48.0	2073		26.0	1560

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
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356 WINCHESTER

The 356 Winchester is basically a rimmed 358 Winchester for use in traditional lever-action rifles. It is a companion cartridge to the 307 Winchester, and both were introduced in modified Winchester 94 rifles designed to handle higher pressures than those of the 30-30 cartridge. The 356 gives the lever rifle hunter a significant increase in performance over the 35 Remington, and can be used on game up to elk and moose if the range isn't too great.

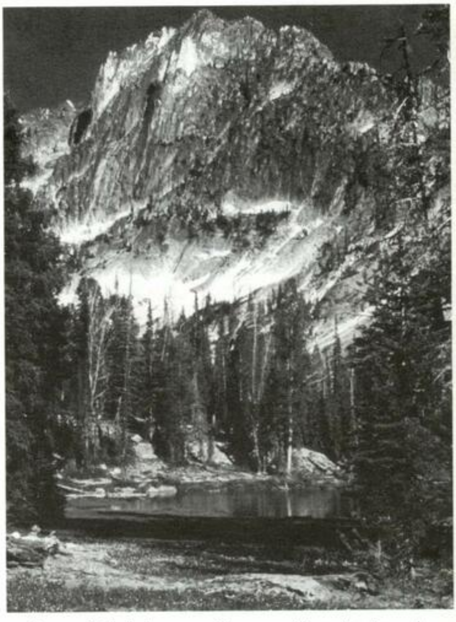
Although it shares most external dimensions with the 358 Winchester, the 356 has heavier walls which reduce its case capacity. 358 Winchester reloading data must not be used for loading this cartridge. Since the 356 shares rim dimensions with the 30-30 cartridge, it is technically a semi-rimmed case.

As with other cartridges for tubular magazines, the 356 Winchester must be loaded with flat point bullets to prevent the hazards of cartridges exploding in the magazine. Speer's 180 and 220 grain flat points both perform well in this cartridge. Shortly after the 356 was announced, Speer modified the cannelure position of these bullets to provide the correct cartridge overall length for reliable feeding in lever-action rifles.

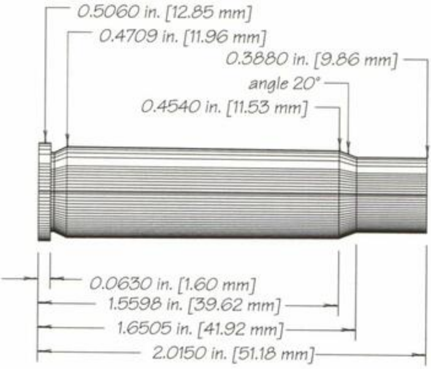
Several Speer handgun bullets intended for the 357 Magnum cartridge can be used in the 356 for low-cost practice and short-range varmint shooting. However, do not use them on any animal larger than a coyote. These bullets have very limited penetration at rifle velocities.

Marlin once made rifles for this cartridge but, at press time, Winchester is the only firm continuing to sell 356 rifles.

Propellants in the middle of the burning rate range gave the best performance in the 356 Winchester. The industry working pressure for the 356 Winchester is 52,000 cup. These loads do not exceed that limit.



Some of Idaho's natural beauty. (Don Andersen)


0.5060 in. [12.85 mm]
0.4709 in. [11.96 mm]
0.3880 in. [9.86 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0630 in. [1.60 mm]
1.5598 in. [39.62 mm]
1.6505 in. [41.92 mm]
2.0150 in. [51.18 mm]

Max. Case Length: 2.015"
Trim-to Length: 2.005"
Max. Cart. Length: 2.560"
RCBS Shellholder: #2
Barrel Length: 20"
Twist: 1-12"

Test Firearm: Winchester 94 AE
Case: W-W
Primers: CCI 200, 250

.357" Dia. **140 Grain** Sect. Density .157	**38** **JHP**					
Ballistic Coefficient	0.152					
C.O.L. Tested At	2.315"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**52.0**	**2697**	**IMR 4198**	**42.0**	**2621**	**Re7**	**42.0**	**2448**
	48.0	2256		38.0	2401		38.0	2211

Notes: Bold print denotes maximum loads. They should be used with caution.

.357" Dia.
158 Grain
Sect. Density .177

	38 JHP	38 JSP				
Ballistic Coefficient	0.158	0.150				
C.O.L. Tested At	2.315"	2.315"				
Speer Part No.	4211	4217				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**49.0**	**2574**	**IMR 3031**	**49.0**	**2504**	**Re7**	**40.0**	**2329**
	45.0	2435		45.0	2174		36.0	2131

.358" Dia.
180 Grain
Sect. Density .201

	35 Flat-SP					
Ballistic Coefficient	0.245					
C.O.L. Tested At	2.550"					
Speer Part No.	2435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**47.0C**	**2654**	**IMR 4064**	**50.0**	**2470**	**Re7**	**40.0**	**2358**
	43.0	2321		46.0	2318		36.0	2095
Viht. N133	**46.0C**	**2577**	**BL-C(2)***	**51.0C**	**2466**	**748***	**51.0**	**2351**
	42.0	2354		47.0	2267		47.0	2175
H322	**48.0**	**2569**	**IMR 4895**	**49.0**	**2403**	**IMR 4320**	**47.0**	**2328**
	44.0	2310		45.0	2169		43.0	2180
H335*	**48.0**	**2502**	**IMR 3031**	**46.0**	**2395**			
	44.0	2284		42.0	2150			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.358" Dia. **220 Grain** Sect. Density .245	35 Flat-SP					
Ballistic Coefficient	0.316					
C.O.L. Tested At	2.550"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**42.0C**	**2344**	**H322**	**43.0**	**2285**	**BL-C(2)***	**46.0C**	**2242**
	38.0	2114		39.0	2117		42.0	2032
748*	**49.5**	**2328**	**IMR 4320**	**46.0**	**2273**	**H380***	**50.0C**	**2116**
	45.5	2143		42.0	2099		46.0	1973
Viht. N135	**45.0C**	**2306**	**H335***	**43.0**	**2258**	**Re7**	**35.0**	**2090**
	41.0	2128		39.0	2040		31.0	1865
IMR 4064	**46.0**	**2301**	**IMR 4895**	**46.0**	**2243**			
	42.0	2024		42.0	1987			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

358 WINCHESTER

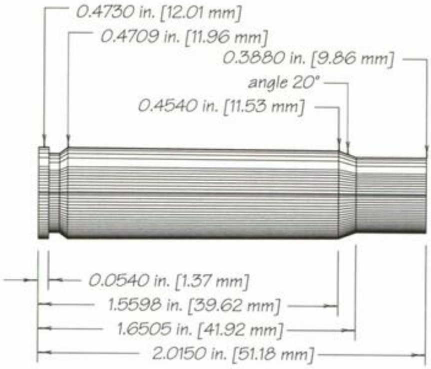
The 358 Winchester is a short- to medium-range cartridge suitable for almost any type of North American game within its range limitations. It is simply a 308 Winchester case necked up to handle .358" diameter bullets. It was introduced in 1955 and originally chambered in the Winchester Model 70 bolt action rifle. Later, Winchester offered the 358 in the Model 88 rifle, a sleek lever-action which proved very accurate. The 358 is often described as an improved version of the old 348 Winchester cartridge, which had an excellent reputation in the woods.

The 358 is one of the best woods cartridges ever designed. It is much superior to the 35 Remington and it is surprising that the 358 has not been more popular. We can only assume that it fell victim to "magnum-mania". The deer and elk hunter would be hard-pressed to find another cartridge which would show significant gains in field performance over that of the 358 unless he needs something for longer shots. The 358 is limited to about 200 yards effective hunting range.

Factory ammunition is loaded with 200 and 250 grain bullets. The handloader has more flexibility, since he can use .357" diameter pistol bullets for varmints or inexpensive practice. The 180 grain Speer flat point is excellent for whitetail deer under almost any hunting conditions within the cartridge's range. For black bear, elk and moose at moderate ranges, the 220 grain flat point is a better choice. For longer ranges, the 250 grain spitzer and the 250 grain Grand Slam get the nod. Although the 358's velocity is a little low for large bears, it can certainly handle them in a pinch.

In addition to the Winchester rifles, both Savage and Browning have made 358 rifles. Ruger made a short run of their Model 77 bolt-action rifles in this caliber in the early 1970's and these rifles are in demand among Ruger collectors. The 358 has also been reasonably popular with custom rifle builders.

If factory cases are not readily available, they can be made from 308 Winchester cases with a minimum of additional equipment. When using reformed cases, reduce starting loads by five percent and carefully work up from there. The 358 Winchester's industry pressure limit is 52,000 cup; these loads remain within that limit.


0.4730 in. [12.01 mm]
0.4709 in. [11.96 mm]
0.3880 in. [9.86 mm]
angle 20°
0.4540 in. [11.53 mm]
0.0540 in. [1.37 mm]
1.5598 in. [39.62 mm]
1.6505 in. [41.92 mm]
2.0150 in. [51.18 mm]

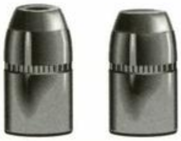
Max. Case Length: 2.015"
Trim-to Length: 2.005"
Max. Cart. Length: 2.780"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-12"

Test Firearm: Savage Model 99
Case: W-W
Primers: CCI 200, 250

.357" Dia. **140 Grain** Sect. Density .157	**38 JHP**					
Ballistic Coefficient	0.152					
C.O.L. Tested At	2.315"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**50.0**	**2994**	H322	**52.0**	**2808**	IMR 3031	**51.0**	**2749**
	46.0	2729		48.0	2563		47.0	2513

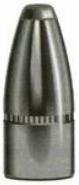
Notes: Bold print denotes maximum loads. They should be used with caution.



.357" Dia.
158 Grain

Sect. Density .177	38 JHP	38 JSP				
Ballistic Coefficient	0.158	0.150				
C.O.L. Tested At	2.315"	2.315"				
Speer Part No.	4211	4217				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**48.0**	**2850**	**H322**	**52.0**	**2782**	**IMR 4064**	**52.0**	**2730**
	44.0	2512		48.0	2535		48.0	2496



.358" Dia.
180 Grain

Sect. Density .201	35 Flat-SP					
Ballistic Coefficient	0.245					
C.O.L. Tested At	2.680"					
Speer Part No.	2435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**52.0**	**2732**	**H322**	**50.0**	**2681**	**BL-C(2)***	**53.0C**	**2590**
	48.0	2511		46.0	2467		49.0	2416
Re7	**45.0**	**2728**	**IMR 4198**	**42.0**	**2674**	**748***	**53.0**	**2565**
	41.0	2456		38.0	2379		49.0	2339
IMR 3031	**51.0**	**2721**	**Viht. N133**	**48.0C**	**2668**	**IMR 4320**	**51.0**	**2565**
	47.0	2481		44.0	2469		47.0	2420
IMR 4895	**51.0**	**2701**	**AA 2015BR**	**47.0C**	**2628**			
	47.0	2467		43.0	2401			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.358" Dia. **220 Grain** Sect. Density .245	35 Flat-SP					
Ballistic Coefficient	0.316					
C.O.L. Tested At	2.680"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**52.0C**	**2481**	**H322**	**45.0**	**2411**	**AA 2015BR**	**43.0**	**2368**
	48.0	2328		41.0	2058		39.0	2186
Viht. N135	**48.0C**	**2452**	**H335***	**47.5**	**2405**	**BL-C(2)***	**50.0C**	**2366**
	44.0	2290		43.5	2227		46.0	2191
IMR 3031	**47.0**	**2450**	**IMR 4064**	**48.0**	**2404**	**H380***	**50.0C**	**2214**
	43.0	2215		44.0	2262		46.0	1992
AA 2520*	**48.0C**	**2431**	**IMR 4320**	**47.5**	**2371**	**Re7**	**38.0**	**2193**
	44.0	2269		43.5	2197		34.0	2077

.358" Dia. **250 Grain** Sect. Density .279	35 Spitz-SP	35 GS-SP				
Ballistic Coefficient	0.446	0.335				
C.O.L. Tested At	2.760"	2.760"				
Speer Part No.	2453	2455				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**45.0**	**2333**	**IMR 4064**	**44.0**	**2264**	**IMR 3031**	**42.0**	**2240**
	41.0	2119		40.0	2039		38.0	2011
AA 2015BR	**42.0**	**2314**	**BL-C(2)***	**47.0C**	**2261**	**Re7**	**37.0**	**2169**
	38.0	2141		43.0	2069		33.0	1919
Viht. N135	**46.0C**	**2302**	**748***	**47.0C**	**2255**			
	42.0	2127		43.0	2031			
H322	**43.0**	**2289**	**IMR 4320**	**44.0**	**2241**			
	39.0	2053		40.0	2007			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

35 WHELEN

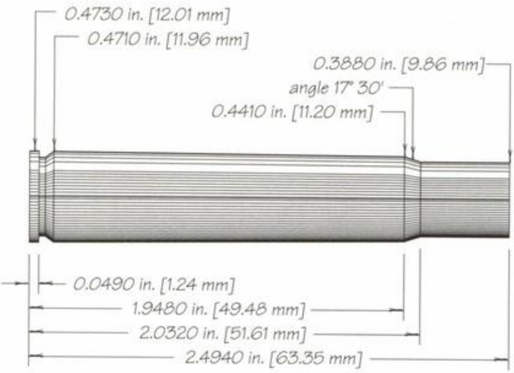
One of the most successful wildcat cartridges of the 20th century, the 35 Whelen appeared in the early 1920's when famous gun maker James Howe necked up standard 30-06 cases to accept 0.358" bullets. Named for the noted shooting authority, Townsend Whelen, this cartridge became very popular. Since it is the same length as the 30-06, it could be built on standard-length actions. It proved to be an excellent cartridge for all North American game, and allowed budget-minded shooters to bridge the performance gap between the 30-06 and expensive 375 H&H rifles.

Remington has been the industry leader in converting excellent wildcats into commercial cartridges. In 1987, they announced that they would offer production rifles and factory ammunition in 35 Whelen. Factory loads include a 200 grain bullet at 2675 feet/sec and a 250 grain bullet at 2400 feet/sec.

Speer sells four Hot-Cor 35 caliber rifle bullets: flat point designs in 180 and 220 grains, a 250 grain spitzer and a 250 grain Grand Slam. The two flat point bullets are fine for game up to deer and the 250 grain bullets should handle any other North American game. The Grand Slam should be chosen for large bear where deep penetration and bullet integrity are vital. For close-range varmint shooting or inexpensive plinking, the Speer 158 grain jacketed handgun bullets (.357" diameter) can be used. Remember that most handgun bullets are designed for maximum expansion in the range of 1000 to 1500 foot/sec. Driven at higher velocities, they expand explosively but give little penetration. For this reason, loads shown with bullets lighter than 180 grains should not be used on any animal larger than a coyote.

Powders of moderate burning rates provide the best performance in the Whelen. Because the case has a minimum amount of shoulder, the slow-burning propellants often give less velocity even with heavy bullets. Powders like IMR 4064, H335, AA 2460, WC 748 and Reloder 15 worked well in this case. We used commercial Remington cases for the data development so, if you plan to use reformed military 30-06 cases, reduce the starting loads by five percent and work up slowly. Shoulder position is important for reliable ignition, case life and accuracy. Avoid pushing the shoulder back during resizing or case forming.

Factory 250 grain soft point ammo gave an average velocity of 2350 feet/sec in our test rifle. The SAAMI maximum average pressure for the 35 Whelen is 52,000 cup and these loads do not exceed this limit.


0.4730 in. [12.01 mm]
0.4710 in. [11.96 mm]
0.3880 in. [9.86 mm]
angle 17° 30'
0.4410 in. [11.20 mm]
0.0490 in. [1.24 mm]
1.9480 in. [49.48 mm]
2.0320 in. [51.61 mm]
2.4940 in. [63.35 mm]

Max. Case Length: 2.494"
Trim-to Length: 2.484"
Max. Cart. Length: 3.340"
RCBS Shellholder: #3
Barrel Length: 22"
Twist: 1-16"

Test Firearm: Remington Model 700
Case: R-P
Primers: CCI 200, 250

.357" Dia.
158 Grain

Sect. Density .177	38 JHP	38 JSP				
Ballistic Coefficient	0.158	0.150				
C.O.L. Tested At	2.795"	2.795"				
Speer Part No.	4211	4217				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	42.0	2193	**AA 2015BR**	40.0	2125	**IMR 4895**	45.0	1979
	Do not reduce.			Do not reduce.			Do not reduce.	

.358" Dia. **180 Grain** Sect. Density .201	**35** **Flat-SP**					
Ballistic Coefficient	0.245					
C.O.L. Tested At	3.030"					
Speer Part No.	2435					

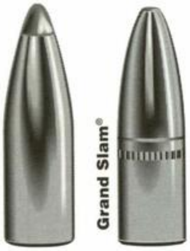
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**65.0C**	**2891**	**AA 2520***	**59.0C**	**2786**	**Viht. N135**	**59.0C**	**2734**
	61.0	2804		55.0	2668		55.0	2615
AA 2460*	**60.0C**	**2860**	**H4895**	**58.0C**	**2782**	**IMR 4064**	**60.0C**	**2731**
	56.0	2272		54.0	2594		56.0	2510
AA 2230	**58.0C**	**2852**	**Viht. N140**	**62.0C**	**2771**	**Re12**	**60.0C**	**2722**
	54.0	2671		58.0	2636		56.0	2543
AA 2015BR	**54.0**	**2797**	**IMR 4895**	**57.0C**	**2762**	**Re15**	**60.0C**	**2678**
	50.0	2563		53.0	2512		56.0	2485
H322	**58.0C**	**2797**	**IMR 3031**	**57.0C**	**2741**	**IMR 4320**	**57.0**	**2593**
	54.0	2645		53.0	2472		53.0	2319

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.358" Dia. **220 Grain** Sect. Density .245	**35** **Flat-SP**					
Ballistic Coefficient	0.316					
C.O.L. Tested At	3.230"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**60.0C**	**2599**	**Viht. N140**	**58.0C**	**2480**	**AA 2520***	**54.0**	**2429**
	56.0	2422		54.0	2310		50.0	2348
748*	**63.0C**	**2560**	**IMR 3031**	**55.0C**	**2478**	**H380***	**61.0C**	**2422**
	59.0	2515		51.0	2275		57.0	2281
H335*	**56.0**	**2558**	**BL-C(2)***	**57.0**	**2456**	**Re12**	**54.0**	**2397**
	52.0	2293		53.0	2350		50.0	2291
AA 2495	**53.0**	**2503**	**Viht. N135**	**55.0C**	**2452**	**IMR 4895**	**53.0**	**2378**
	49.0	2297		51.0	2282		49.0	2312
AA 2460*	**54.0**	**2494**	**IMR 4064**	**56.0C**	**2444**	**H322**	**49.0**	**2375**
	50.0	2368		52.0	2242		45.0	2219

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.358" Dia. **250 Grain** Sect. Density .279	35 Spitz-SP	35 GS-SP				
Ballistic Coefficient	0.446	0.335				
C.O.L. Tested At	3.340"	3.265"				
Speer Part No.	2453	2455				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**53.0**	**2386**	**IMR 4064**	**53.0**	**2311**	**AA 2520***	**50.0**	**2255**
	49.0	2204		49.0	2050		46.0	2137
748*	**57.0**	**2350**	**Viht. N140**	**54.0**	**2299**	**AA 2015BR**	**47.0**	**2244**
	53.0	2277		50.0	2130		43.0	2159
AA 2495	**51.0**	**2339**	**H380***	**59.0C**	**2287**	**IMR 3031**	**51.0**	**2244**
	47.0	2148		55.0	2143		47.0	2060
AA 2460*	**52.0**	**2334**	**Re15**	**54.0**	**2284**	**H322**	**48.0**	**2181**
	48.0	2193		50.0	2134		44.0	2120
BL-C(2)*	**54.0**	**2314**	**Re12**	**52.0**	**2266**	**IMR 4895**	**49.0**	**2142**
	50.0	2163		48.0	2181		45.0	2084

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

358 NORMA MAGNUM

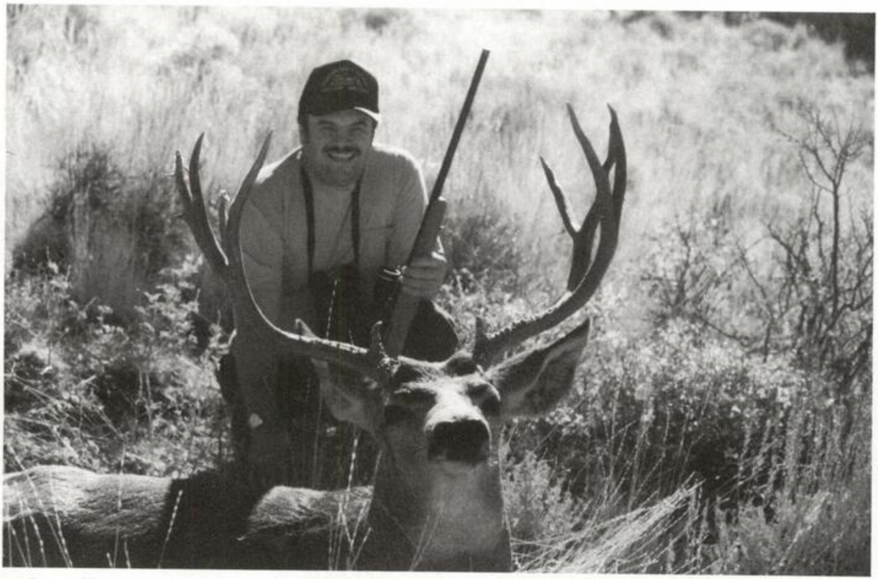
Norma of Sweden introduced the 358 Magnum to the U.S. market in 1959. They made unprimed brass available before importing loaded ammunition. Initial interest in the cartridge was quite high but has waned in recent years. The Norma cartridge has a velocity advantage over the 35 Whelen of up to 300 feet/sec but isn't quite up to the level of the 375 H&H. Because it falls in the short magnum class, it can be chambered in standard-length actions.

Factory rifles for this cartridge have never been produced in the U.S.; however, several custom rifle makers have chambered for it. Swedish Husqvarna rifles and Schultz & Larsen rifles from Denmark have also been chambered for the 358 Magnum.

The 358 Norma Magnum is overpowered for any deer species but would be a good choice for Alaskan hunting. The 180 grain Speer soft point should not be used on larger game in the 358 Norma because it was designed for cartridges that produce much lower velocities. The Speer 250 grain spitzer and Grand Slam are the best bullets in this cartridge.

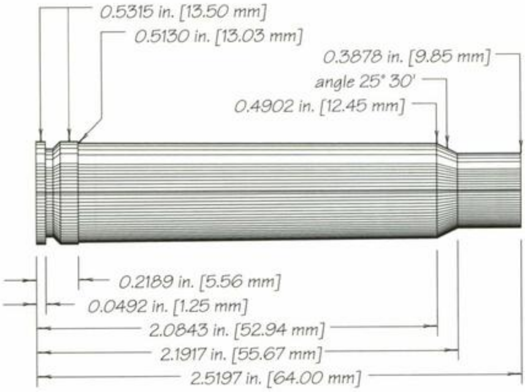
Norma ammunition and components are imported into the U.S. and their availability has improved in the last several years. If factory brass cannot be readily found in your area, cases can be made by necking up 338 Winchester cases and fire-forming.

There is no SAAMI pressure standard for the 358 Norma. Therefore, these loads were not pressure tested, but were completely safe in several test rifles.



Larry Teague, RCBS employee, with the nice muley he bagged near Winnemucca, Nevada. (.300 Mag, 180 gr. Grand Slam)

358 NORMA MAGNUM


0.5315 in. [13.50 mm]
0.5130 in. [13.03 mm]
0.3878 in. [9.85 mm]
angle 25° 30'
0.4902 in. [12.45 mm]
0.2189 in. [5.56 mm]
0.0492 in. [1.25 mm]
2.0843 in. [52.94 mm]
2.1917 in. [55.67 mm]
2.5197 in. [64.00 mm]

Max. Case Length: 2.520"
Trim-to Length: 2.510"
Max. Cart. Length: 3.400"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-12"

Test Firearm: Custom Winchester Model 70
Case: Norma
Primers: CCI 250

.358" Dia. **180 Grain** Sect. Density .201	**35** **Flat-SP**					
Ballistic Coefficient	0.245					
C.O.L. Tested At	3.340"					
Speer Part No.	2435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895*	**69.0**	**3133**	**H380***	**72.0**	**3075**	Reduced Load **SR 4759***	**32.0**	**2013**
	65.0	2943		68.0	2910		28.0	1769
IMR 4320*	**72.0**	**3132**	**IMR 4350***	**78.0**	**2948**			
	68.0	2945		74.0	2778			
IMR 4064*	**71.0**	**3124**	**H414***	**77.0**	**2836**			
	67.0	2933		73.0	2652			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.358" Dia.
250 Grain
Sect. Density .279

	35 Spitz-SP	35 GS-SP				
Ballistic Coefficient	0.446	0.335				
C.O.L. Tested At	3.340"	3.340"				
Speer Part No.	2453	2455				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**76.0**	**2732**	IMR 4064*	**65.0**	**2638**	H380*	**67.0**	**2576**
	72.0	2581		61.0	2458		63.0	2429
IMR 4320*	**67.0**	**2644**	IMR 4895*	**63.0**	**2584**	Reduced Load SR 4759*	**32.0**	**1821**
	63.0	2483		59.0	2414		28.0	1586

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

9.3 x 62mm

Although seldom seen in the United States, 9.3mm (.366") rifles have enjoyed reasonable popularity in the rest of the world. In African countries which are former Dutch or German colonies, metric medium-caliber rifles remain quite common.

The 9.3 x 62mm has consistently been one of the more popular of the various 9.3mm cartridges. Because it can be chambered in standard length bolt-action rifles at reasonable cost, it has seen wider distribution than other 9.3mm's designed for more expensive single-shot and double rifles or rifle/shotgun combinations.

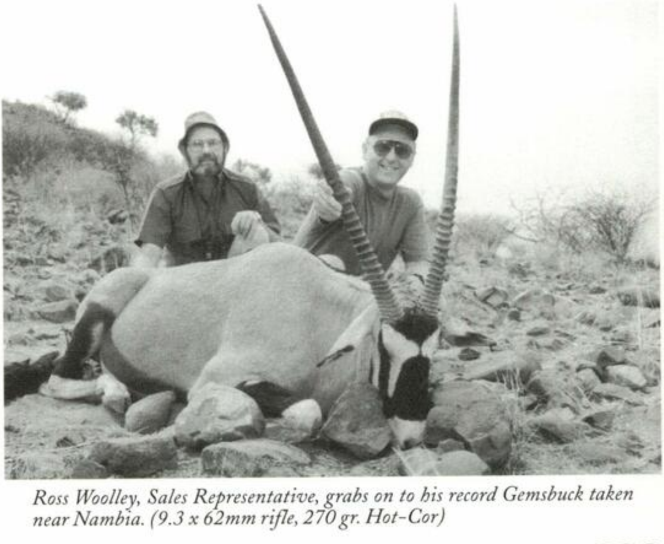
Factory ammunition is usually loaded with 286 grain bullets, although Norma has listed one load at 232 grains. Factory ballistics put the 9.3 x 62mm slightly ahead of the 35 Whelen and about equal the the wildcat 338-06. Handloaded with Speer's 270 grain .366" semi-spitzer, the 9.3mm enjoys a modest energy advantage over the 338-06.

For many rifles, case-forming involves simply necking up 30-06 or 35 Whelen brass in the 9.3 x 62mm sizer die. RCBS dies for this cartridge are furnished with a tapered expander ball to perform this operation in one pass.

However, the chamber shoulder may vary from one rifle to another, and a modified case-forming technique can be used to optimize accuracy and case life. Use a .375" tapered expander to neck up 35 Whelen cases. Gradually size these cases in a 9.3 x 62mm sizer die, pushing the new shoulder back a little at a time until the rifle's action fully closes on the case with slight resistance. This will leave an auxiliary shoulder to support the case against the firing pin blow. Load with a charge at about 90% of maximum and fire-form. The case shoulder will then be precisely positioned for your rifle. Avoid moving the small shoulder during subsequent resizing. This can create excessive headspace.

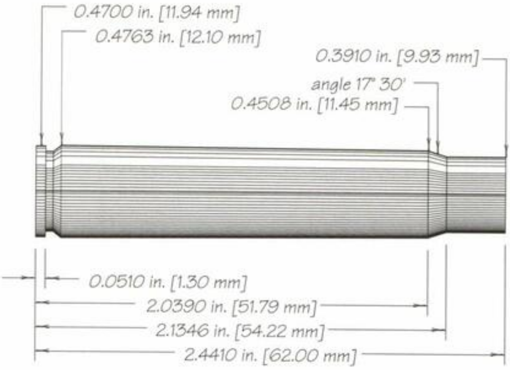
The 9.3 x 62mm can be used on any North American game. Although seldom considered for deer, its modest velocities produce less meat damage than many popular 7mm and 30 caliber "Magnum" cartridges.

The loads listed were tested by case head expansion because there are no U.S. standards for the 9.3 x 62mm. All loads were safe in our test rifle.



Ross Woolley, Sales Representative, grabs on to his record Gemsbuck taken near Nambia. (9.3 x 62mm rifle, 270 gr. Hot-Cor)

9.3 x 62mm


0.4700 in. [11.94 mm]
0.4763 in. [12.10 mm]
0.3910 in. [9.93 mm]
angle 17° 30'
0.4508 in. [11.45 mm]
0.0510 in. [1.30 mm]
2.0390 in. [51.79 mm]
2.1346 in. [54.22 mm]
2.4410 in. [62.00 mm]

Max. Case Length: 2.441"
Trim-to Length: 2.431"
Max. Cart. Length: 3.290"
RCBS Shellholder: #3
Barrel Length: 26"
Twist: 1-10"

Test Firearm: Custom Remington Model 700
Case: Reformed W-W
Primers: CCI 200, 250

.366" Dia. **270 Grain** Sect. Density .288	**9.3mm SSpitz-SP**					
Ballistic Coefficient	0.361					
C.O.L. Tested At	3.280"					
Speer Part No.	2459					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H414*	**60.0**	**2583**	**H380***	**59.0**	**2542**	**IMR 4831***	**64.0**	**2493**
	56.0	2388		55.0	2310		60.0	2166
760*	**60.0**	**2552**	**IMR 4064**	**58.0**	**2530**	**748***	**54.0**	**2440**
	56.0	2408		54.0	2403		50.0	2253
IMR 4350*	**64.0**	**2550**	**IMR 4895**	**56.0**	**2495**			
	60.0	2486		52.0	2340			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

9.3x74R

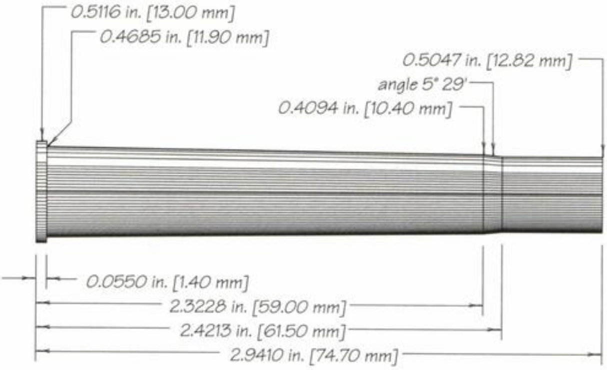
This metric cartridge dates to the turn of the century. It evolved as a smokeless powder update of the old 9.3x72R cartridge which was developed for black powder. The 72mm version had a straight tapered case while the newer 74mm version has a slight shoulder and a longer case to prevent it from accidently being fired in rifles chambered for the older cartridge.

Because of its impressive length, the cartridge isn't suitable for repeating arms. It is most commonly encountered in single-shots, double rifles and combination guns. The cartridge was little known in North America other than by a few shooters who brought back war souvenirs from Europe. However, in the 1980's Valmet of America imported the excellent Model 412S over/under rifle in 9.3x74R. There are also a number of European gun makers who still chamber it in rifles and combination guns. Beretta, Bernardelli and Heym rifles are imported into this country. Cases are the greatest limitation because they cannot be made from any existing brass. However, they are now imported by both RWS and Norma.

Speer makes one bullet in .366" diameter for the 9.3mm. It weighs 270 grains and is a Hot-Cor design for tough game. The 9.3x74R is suitable for anything on the North American continent and on lighter African game in countries where game regulations allow this bore diameter (some countries specify a minimum caliber of 375).

No SAAMI pressure standards exist for this cartridge. These loads closely approximate the velocities of European factory ammunition, and were completely safe in the test rifle.

9.3 x 74R


0.5116 in. [13.00 mm]
0.4685 in. [11.90 mm]
0.5047 in. [12.82 mm]
angle 5° 29'
0.4094 in. [10.40 mm]
0.0550 in. [1.40 mm]
2.3228 in. [59.00 mm]
2.4213 in. [61.50 mm]
2.9410 in. [74.70 mm]

Max. Case Length: 2.941"
Trim-to Length: 2.931"
Max. Cart. Length: 3.665"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Valmet Model 412S
Case: RWS
Primers: CCI 200

.366" Dia. **270 Grain** Sect. Density .288	**9.3mm SSpitz-SP**					
Ballistic Coefficient	0.361					
C.O.L. Tested At	3.665"					
Speer Part No.	2459					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380	**61.0**	**2328**	**IMR 4064**	**58.0**	**2379**	**AA 3100**	**64.0C**	**2086**
	57.0	2183		54.0	2157		60.0	1898
IMR 4350	**65.0C**	**2306**	**IMR 4831**	**66.0**	**2264**	Reduced Load **SR 4759**	**25.0**	**1537**
	61.0	2113		62.0	2156		21.0	1252
IMR 4895	**55.0**	**2288**	**748**	**60.0**	**2235**			
	51.0	2097		56.0	2108			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

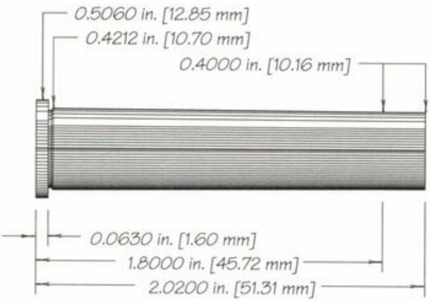
375 WINCHESTER

The 375 Winchester was announced in 1978 by Winchester as a new woods cartridge for the Model 94 Big Bore, a strengthened version of the popular Model 94 carbine. Actually, the 375 is a modernized, high-pressure version of the old 38-55 Winchester cartridge. The 38-55 has a well-earned reputation for accuracy and woods performance but operates at relatively low pressures (less than 30,000 c.u.p.). Externally, the 375 uses a slightly shortened 38-55 case with much heavier walls to contain the higher operating pressures.

In addition to the Winchester Big Bore, Ruger's No. 3 single shot carbine and a few Marlin Model 336 carbines have been chambered for the 375 Winchester cartridge. However, a quick review of the literature at press time showed no current rifles chambered for this cartridge. Thompson/Center offers 375 Winchester barrels for its popular Contender single-shot pistol and it is proving to be an excellent combination for the handgun hunter. See the Handgun section for more information.

The 375 Winchester can be used on most North American game at modest ranges with the exception of the great bears. Its effective hunting range is well under 200 yards but it would be hard to beat the 375 in the eastern woods. Speer does not manufacture a .375" diameter bullet which is suitable for use in a tubular magazine. The 235 grain semi-spitzer bullet can be used in single-shot rifles, or loaded singly into the chamber of a lever rifle. HANDLOADS USING THIS BULLET MUST NOT BE USED IN ANY TUBULAR MAGAZINE.

The industry maximum pressure for the 375 Winchester is 52,000 cup. NEVER ATTEMPT TO FIRE 375 WINCHESTER AMMUNITION IN ANY RIFLE CHAMBERED FOR THE 38-55 CARTRIDGE. Rifles chambered for the 38-55 cartridge were never designed to handle pressures in this range and property damage and or personal injury can result.


0.5060 in. [12.85 mm]
0.4212 in. [10.70 mm]
0.4000 in. [10.16 mm]
0.0630 in. [1.60 mm]
1.8000 in. [45.72 mm]
2.0200 in. [51.31 mm]

Max. Case Length: 2.020"
Trim-to Length: 2.010"
Max. Cart. Length: 2.560"
RCBS Shellholder: #2
Barrel Length: 20"
Twist: 1-12"

Test Firearm: Winchester Model 94 BB
Case: W-W
Primers: CCI 200
Comments: Do not use 235 SS bullets in tubular magazines.

.375" Dia. **235 Grain** Sect. Density .239	375 **SSpitz-SP**					
Ballistic Coefficient	0.317					
C.O.L. Tested At	2.560"					
Speer Part No.	2471					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**35.0C**	**2067**	Viht. N133	**37.0C**	**1963**	H322	**35.0**	**1851**
	31.0	1810		33.0	1740		31.0	1662
IMR 4198	**32.0**	**1987**	IMR 4895	**36.0C**	**1933**	IMR 3031	**35.0C**	**1779**
	28.0	1727		32.0	1580		31.0	1536
AA 2015BR	**36.0C**	**1975**	AA 2230	**37.5C**	**1911**			
	32.0	1742		33.5	1721			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

375 H&H MAGNUM

The 375 H&H dates to 1912 when it was introduced by the famous English gunmaking firm of Holland & Holland. It was one of the first belted cases and quickly established itself as a premier heavy game cartridge. In some African countries, it is the minimum bore diameter which can be used. With proper bullet selection and reasonable hunting skill, the 375 can take any game known to man.

Factory ammunition was first offered in the U.S. by the Western Cartridge Company in 1925; however, it wasn't until 1937 that an American-made rifle—the Winchester Model 70—was available. Since then Remington, Browning, Ruger and others have chambered the 375. It is just as popular today as ever, putting it among the oldest chamberings surviving today. Quality American-made rifles in this caliber have been continually available since 1937 (except during World War II when sporting arms were unavailable in any caliber).

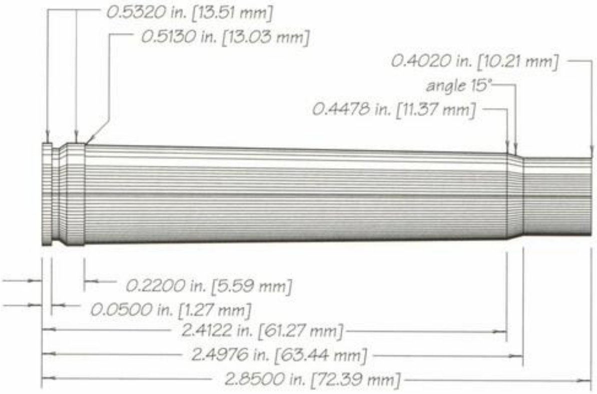
Although theoretically too powerful for North American game other than the largest bears, the 375 is still popular on this continent. Part of the continued popularity is because of the 375's inherent accuracy and flat trajectory. Sighted for 300 yards, the 235 grain semi-spitzer at 2900 feet/sec rises only 5.5 inches at 200 yards. The 300 yard energy is still 2250 foot-pounds! This type of performance shows why the 375 is a popular, long-range elk cartridge.

The 235 grain Speer Hot-Cor semi-spitzer was designed to give reduced recoil for practice and hunting lighter game. Loaded down to 2600 feet/sec, it can be used on deer. At this velocity, damage to edible meat is usually less than caused by smaller, high-velocity bullets. The 270 grain boat tail is excellent for long shots in open country. An interesting observation is that many 375 H&H rifles seem to be able to place bullets of different weights very near the same point of impact.

For African game, the 375 is very versatile. Although marginal for elephant, the cartridge has killed many of them through the years. It is quite adequate for Cape buffalo with the proper bullet, and its flat shooting qualities make the 375 an excellent choice for plains game at long ranges. Of the four Speer bullets in this caliber, we recommend the 285 grain Grand Slam soft point and the 300 grain African Grand Slam tungsten solid for African hunting. Use the soft point Grand Slam on plains game and big cats, and either the soft point or solid on buffalo. Where the 375 is legal for elephant, the solid should be chosen.

After over 80 years on the shooting scene, the 375 H&H has proved its ability to age gracefully. There aren't really any new developments which seriously threaten to unseat it as the "king of the medium calibers".

The data shown here does not exceed the industry maximum pressure of 53,000 cup.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.4020 in. [10.21 mm]
angle 15°
0.4478 in. [11.37 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.4122 in. [61.27 mm]
2.4976 in. [63.44 mm]
2.8500 in. [72.39 mm]

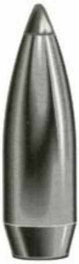
Max. Case Length: 2.850"
Trim-to Length: 2.840"
Max. Cart. Length: 3.600"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-12"

Test Firearm: Remington Model 700
Case: W-W
Primers: CCI 200, 250

.375" Dia. 235 Grain Sect. Density .239	**375 SSpitz-SP**					
Ballistic Coefficient	0.317					
C.O.L. Tested At	3.600"					
Speer Part No.	2471					

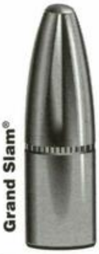
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H380*	**84.0C**	**2982**	**IMR 4350**	**85.0C**	**2898**	**760***	**86.0C**	**2703**
	80.0	2793		81.0	2770		82.0	2543
Re15*	**80.0C**	**2979**	**Viht. N140***	**78.0C**	**2873**	**AA 3100***	**86.0C**	**2657**
	76.0	2852		74.0	2775		82.0	2538
IMR 4064	**77.0C**	**2967**	**IMR 4831**	**85.0C**	**2809**	**Re19***	**84.0C**	**2620**
	73.0	2802		81.0	2680		80.0	2442
IMR 3031	**75.0C**	**2915**	**H414***	**86.0**	**2769**	**H450***	**81.0C**	**2473**
	71.0	2703		82.0	2596		77.0	2638
IMR 4895	**74.0C**	**2909**	**AA 2700***	**80.0C**	**2764**	Reduced Load **SR 4759**	**30.0C**	**1701**
	70.0	2696		76.0	2637		26.0	1500

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.375" Dia. 270 Grain Sect. Density .274	375 BT Spitz-SP					
Ballistic Coefficient	0.429					
C.O.L. Tested At	3.600"					
Speer Part No.	2472					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**74.0**	**2717**	**H380***	**76.0**	**2637**	**IMR 4831**	**81.0C**	**2604**
	67.0	2453		69.0	2394		73.0	2330
760*	**82.0C**	**2691**	**IMR 4350**	**80.0C**	**2633**	**AA 2700***	**75.0**	**2572**
	74.0	2506		72.0	2399		68.0	2350
H414*	**82.0C**	**2658**	**Re19**	**82.0C**	**2616**	**IMR 3031**	**66.0**	**2551**
	74.0	2451		74.0	2309		60.0	2239

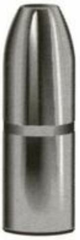


.375" Dia. 285 Grain Sect. Density .354	375 GS-SP					
Ballistic Coefficient	0.354					
C.O.L. Tested At	3.600"					
Speer Part No.	2473					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4350*	**84.0C**	**2756**	**H380***	**78.0C**	**2654**	**Viht. N140***	**68.0**	**2494**
	80.0	2513		74.0	2439		64.0	2367
IMR 4831*	**85.0C**	**2696**	**760***	**86.0C**	**2640**	**H450***	**79.0**	**2476**
	81.0	2520		82.0	2477		75.0	2370
H414*	**86.0C**	**2662**	**Re15***	**72.0**	**2599**	**AA 2700***	**73.0**	**2427**
	82.0	2318		68.0	2480		69.0	2316
IMR 4064*	**73.0C**	**2658**	**IMR 4895***	**69.0**	**2581**	Reduced Load **SR 4759***	**35.0**	**1671**
	69.0	2449		65.0	2369		31.0	1448

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

African Grand Slam®
Tungsten Solid



.375" Dia. 300 Grain Sect. Density .305	375 AGS Solid					
Ballistic Coefficient	0.262					
C.O.L. Tested At	3.440"					
Speer Part No.	2474					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
760*	**79.0C**	**2562**	**IMR 4350***	**78.0C**	**2507**	**AA 4350***	**81.0C**	**2494**
	72.0	2403		71.0	2254		73.0	2250
H4350*	**80.0C**	**2550**	**Re19***	**82.0C**	**2504**	**IMR 4831***	**80.0C**	**2472**
	72.0	2278		74.0	2248		72.0	2212
H414*	**79.0C**	**2521**	**H4831***	**84.0C**	**2499**	**H450***	**82.0C**	**2455**
	72.0	2278		76.0	2233		74.0	2271

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

416 REMINGTON MAGNUM

Renewed interest in heavy rifles led to the introduction of the 416 Remington Magnum in 1988. Based on the 8mm Remington Magnum case, the 416 requires a long action rifle. Remington offers the 416 in their Model 700 Safari rifle.

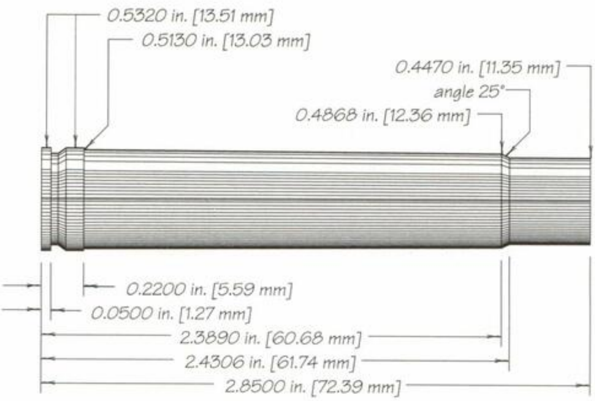
The choice of a .416" diameter bullet seems odd without a look at past heavy rifles. The superb 416 Rigby has been around since 1911; however, its popularity was limited because of the difficulty in obtaining guns and ammunition in this country. The 416 Remington offers the same performance level as the Rigby cartridge—a 400 grain bullet at 2400 feet/sec—but offers the advantage of readily available rifles and ammunition based on a standard, belted case. Several similar wildcat cartridges such as the 416 Taylor and the 416 Hoffman have been used with excellent results—when suitable bullets were available. The introduction of the 416 Remington as a commercial cartridge also resulted in a better selection of bullets for the handloader.

The 416 fills a gap in performance between the 375 H&H and the 458 Winchester Magnum. The 416 has the trajectory advantages of the 375, but with much greater energy. With the proper bullet the 416 should handle any game encountered. Primarily designed for African game, the cartridge is grossly overpowered for North American hunting. However, it is finding a strong following for hunting Alaskan bear. Speer offers two African Grand Slam bullets weighing 400 grains. The soft point should handle most animals but, for the heaviest game, the Tungsten Core Solid will give maximum penetration. For lighter game or inexpensive practice, RCBS sells a bullet mould which casts a 350 grain flat-point, gas check bullet. Reduced recoil practice will appeal to any 416 shooter, since the calculated recoil of full-power loads is greater than the 458 Magnum!

Ammunition used in magazine rifles should be assembled with well-crimped bullets to prevent bullets from moving during recoil. Because the 416 case neck is somewhat thin, it may be necessary to seat and crimp in separate operations. Both Speer .416" bullets feature a generous cannelure for crimping.

Powders which perform well in the 375 H&H generally can be used in the 416. Very slow-burning propellants are not needed in this nearly-straight case. Industry maximum pressure for the 416 is established at 54,000 cup. No SAAMI reference ammunition was available at the time of testing but these loads match the pressures of Remington factory ammunition.

(Editor's note: Just as this manual was going to press, Speer introduced a .416" 350 grain Mag-Tip for North American game. We did not have time to develop data but we will issue a supplemental load sheet for this bullet. Please write us to request a copy. The address is:
Blount SED, ATTN: Technical Services, P.O. Box 856, Lewiston, ID 83501)


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.4470 in. [11.35 mm]
angle 25°
0.4868 in. [12.36 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.3890 in. [60.68 mm]
2.4306 in. [61.74 mm]
2.8500 in. [72.39 mm]

Max. Case Length: 2.850"
Trim-to Length: 2.840"
Max. Cart. Length: 3.600"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Remington Model 700
Case: R-P
Primers: CCI 250

African Grand Slam®

.416" Dia. **400 Grain** Sect. Density .330	**416** **AGS-SP**					
Ballistic Coefficient	0.381					
C.O.L. Tested At	3.580"					
Speer Part No.	2475					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**83.0**	**2402**	**AA 2520***	**76.0C**	**2330**	**Re12***	**78.0**	**2297**
	75.0	2207		69.0	2119		71.0	2038
Re15*	**82.0**	**2402**	**IMR 3031***	**75.0**	**2316**	**IMR 4064***	**78.0C**	**2285**
	74.0	2155		68.0	2107		71.0	2111
BL-C(2)*	**82.0**	**2362**	**IMR 4895***	**75.0C**	**2314**			
	74.0	2144		68.0	2114			

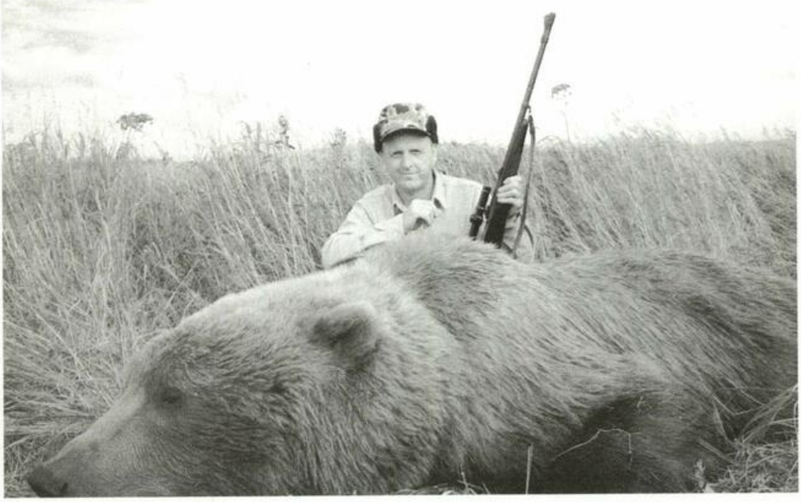
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

African Grand Slam®
Tungsten Solid

.416" Dia. **400 Grain** Sect. Density .330	**416 AGS Solid**				
Ballistic Coefficient	0.262				
C.O.L. Tested At	3.545"				
Speer Part No.	2476				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064*	**78.0C**	**2398**	**BL-C(2)***	**78.0**	**2290**	**IMR 4895***	**73.0**	**2227**
	71.0	2079		71.0	2087		67.0	2029
Re15*	**80.0**	**2376**	**H335***	**74.0**	**2260**	**Re12***	**76.0**	**2203**
	72.0	2066		67.0	2003		69.0	2022
IMR 3031*	**75.0**	**2297**	**AA 2520***	**74.0**	**2259**			
	68.0	2061		67.0	2041			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



Ross Woolley, Sales Representative, with the results of the very first field test of the Speer .416 African Grand Slam soft-point bullet. The huge Alaskan brown bear was taken in the area of Cold Bay, Alaska. (.416 caliber, 400 gr. African Grand Slam soft-point)

44 MAGNUM (Rifle)

Soon after the 44 Remington Magnum revolver cartridge was introduced in 1956, custom gunsmiths saw the potential for a new cartridge in light carbines. They converted old Model 1892 Winchester carbines to 44 Magnum and found they had an effective, short-range woods rifle.

In 1961, Sturm-Ruger designed a new rifle to handle the 44 Magnum. Derived from the gas-operated action of the military M1 carbine, the rifle was a semi-automatic with a tubular magazine that held four cartridges. Later Marlin, Winchester and Browning introduced lever action carbines and Remington built its Model 788 bolt-action in this caliber for a short time.

The various 44 carbines are excellent whitetail deer and black bear rifles for ranges to 100 yards. Beyond this distance, hitting the target becomes more difficult because of the arched trajectory. Although the 44 Magnum generates wicked recoil in a handgun, it is well-behaved in the little carbines and can be easily handled by youngsters or other lightly-built shooters.

The gas-operated action of the Ruger needs full-power loads to cycle the action reliably. Lever guns can be used with somewhat lighter loads, but we recommend that you not go below the minimum loads shown when firing jacketed bullets. Lead bullets should not be used in the Ruger semi-auto because lead fouling can clog the gas system.

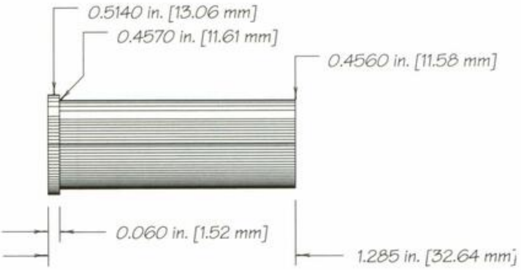
Since almost all 44 carbines have tubular magazines, loaded cartridge length and a firm crimp are critical to reliable function. DO NOT USE THE SPEER 240 GRAIN TMJ SILHOUETTE BULLET IN TUBULAR MAGAZINES; A CARTRIDGE EXPLOSION COULD RESULT.

For coyotes and varmints of similar size, the Speer 200 grain jacketed hollow point works fine but can cause shallow wounds on larger game. The best bullets for deer and black bear are the 240 grain hollow point and soft point. Our preference is the soft point, which retains more weight when fired in carbine barrels. The 300 grain Uni-Cor soft point can also be used. Its trajectory is even more arched than that of the 240 grain bullets, but it is capable of giving very deep penetration, and is a good choice for black bear at close range.

The 300 grain bullet has two cannelures for crimping. THE REAR CANNELURE IS INTENDED FOR REVOLVERS ONLY. The loads listed for the carbine were developed with the bullet crimped in the FRONT cannelure. This sets the proper cartridge overall length for reliable function in repeating rifles.

We no longer recommend the Speer 225 and 240 grain half-jacket bullets for use in tubular magazines. These bullets were designed for revolvers and the crimping shoulder will not always prevent bullet set-back into the case when compressed in a tubular magazine. The newer Speer bullets were designed for use in either revolvers or rifles.

Rifle ammo for the 44 Magnum operates at the same pressure as revolver ammo—36,000 psi. These loads are within that limit.


0.5140 in. [13.06 mm]
0.4570 in. [11.61 mm]
0.4560 in. [11.58 mm]
0.060 in. [1.52 mm]
1.285 in. [32.64 mm]

Max. Case Length: 1.285"
Trim-to Length: 1.275"
Max. Cart. Length: 1.610"
RCBS Shellholder: #18
Barrel Length: 20"
Twist: 1-38"

Test Firearm: Marlin Model 1894
Case: W-W
Primers: CCI 350

.429" Dia. **200 Grain** Sect. Density .122	**44** **JHP**					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.590"					
Speer Part No.	4425					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**28.5**	**2116**	IMR 4227*	**28.0**	**1914**	AA #7*	**18.5**	**1649**
	26.5	1985		26.0	1802		16.5	1503
296*	**28.0**	**2028**	2400*	**21.0**	**1801**	Unique*	**12.4**	**1612**
	26.0	1888		19.0	1648		11.1	1384

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.429" Dia. **240 Grain** Sect. Density .185	**44** **JHP**	**44** **JSP**				
Ballistic Coefficient	0.165	0.164				
C.O.L. Tested At	1.575"	1.575"				
Speer Part No.	4453	4457				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**24.0**	**1788**	**IMR 4227***	**23.4**	**1629**	**HS-7***	**15.8**	**1423**
	22.0	1674		21.4	1503		13.8	1239
296*	**24.0**	**1734**	**2400***	**17.7**	**1506**	**AA #7***	**16.0**	**1400**
	22.0	1625		15.9	1340		14.0	1241
Viht. N110*	**20.0**	**1647**	**AA #9***	**18.0**	**1487**	**H. Universal***	**9.6**	**1237**
	18.0	1545		16.0	1314		8.8	1118

Note: These loads were tested on copper crusher equipment to SAAMI maximum pressure of 40,000 CUP. Velocities fired in 18.5" Ruger Semi-Auto Carbine.

.429" Dia. **300 Grain** Sect. Density .233	**44** **UCSP**					
Ballistic Coefficient	0.213					
C.O.L. Tested At	1.585"					
Speer Part No.	4463					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**20.5**	**1503**	**2400***	**18.5**	**1438**	**AA #9***	**18.0**	**1389**
	18.5	1347		16.6	1246		16.2	1182
296*	**21.0**	**1499**	**IMR 4227***	**21.0**	**1392**	**AA 1680***	**23.0C**	**1319**
	18.9	1337		18.9	1194		20.7	1148

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

444 MARLIN

The American shooting public has an on-going love affair with lever-action rifles. But following World War II, shooters could only buy new lever rifles up to 35 caliber. Larger-bore lever guns which had been around since the 1880's had all been discontinued.

Marlin remedied this situation in 1964 by reintroducing the Model 1895 rifle, a large-frame lever-action which could handle cartridges much larger than the 30-30. In cooperation with Remington, they developed the new 444 Marlin cartridge and chambered it in the Model 1895.

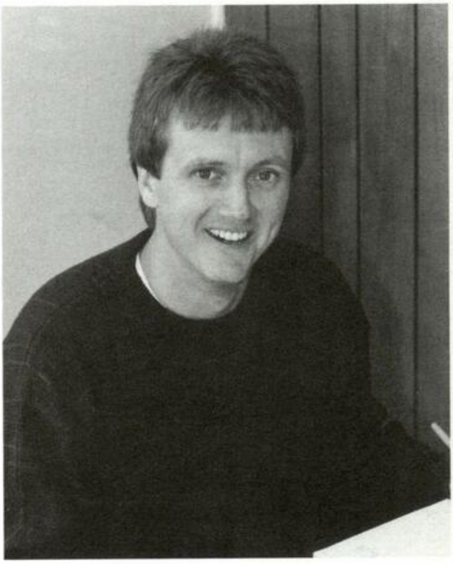
The 444 concept is simply a 44 Magnum case with an extra inch of length. Barrel diameter is the same as the 44 Magnum, so .429" bullets for the handgun cartridge can be used. Factory loads drive a 240 grain jacketed soft point at a nominal velocity of 2300 feet/sec. However, velocities in production rifles can be somewhat lower. The handloader can safely achieve this performance level with several propellants.

The 444 is a fine brush cartridge for deer and black bear out to about 150 yards. The soft point should be chosen over the hollow point to maximize penetration; the hollow point may fragment on impact and cause shallow wounds. The 444 cannot be considered an effective cartridge for larger bear since the bullets available are of light construction and may not give penetrate well enough for reliable grizzly stopping.

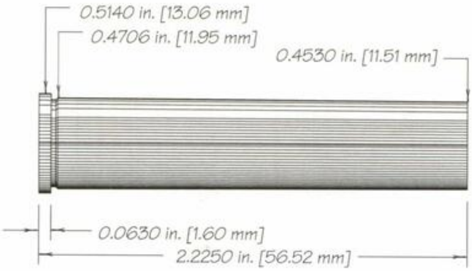
The introduction of heavy 300 grain bullets for 44 Magnum revolvers led to interest in improving the performance of the 444 Marlin. The slow rifling twist (1-in-38") of the Marlin rifle has often been cited as a reason for not using bullets heavier than 265 grains. However, the Speer test rifle and several others have shown excellent accuracy with the Speer 300 grain Uni-Cor™ soft point. In fact, our rifle fired 1.5 inch groups at 100 yards with this bullet —its best groups ever! We can't say that every Marlin will shoot heavy bullets this well but it's worth a try. If your rifle will handle them, you will have greater flexibility for close-range shooting. The 300 grain bullet must be crimped in the front cannelure for proper feeding and chambering.

DO NOT USE THE SPEER 240 GRAIN TMJ SILHOUETTE MATCH BULLET IN TUBULAR MAGAZINES.

The SAAMI pressure limit for the 444 Marlin is 44,000 cup; these loads do not exceed that limit.



Niel Risley, RCBS Customer Service Rep.


0.5140 in. [13.06 mm]
0.4706 in. [11.95 mm]
0.4530 in. [11.51 mm]
0.0630 in. [1.60 mm]
2.2250 in. [56.52 mm]

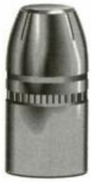
Max. Case Length: 2.225"
Trim-to Length: 2.215"
Max. Cart. Length: 2.570"
RCBS Shellholder: #28
Barrel Length: 24"
Twist: 1-38"

Test Firearm: Marlin M444
Case: R-P
Primers: CCI 200

.429" Dia. **240 Grain** Sect. Density .186	**44** **JHP**	**44** **JSP**				
Ballistic Coefficient	0.165	0.164				
C.O.L. Tested At	2.505"	2.505"				
Speer Part No.	4453	4457				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**51.0C**	**2355**	**Viht. N130**	**50.0**	**2303**	**AA 2015BR**	**52.0**	**2256**
	49.0	2263		48.0	2211		50.0	2169
H322	**55.0**	**2341**	**AA 2230**	**55.0**	**2289**	**IMR 4227**	**41.0**	**2247**
	53.0	2256		53.0	2206		39.0	2137
H4198	**48.0**	**2326**	**IMR 4198**	**47.0**	**2280**	**Viht. N120**	**42.0**	**2198**
	46.0	2231		45.0	2183		40.0	2093

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



Note: Seat bullet to upper cannelure.

.429" Dia. **300 Grain** Sect. Density .233	**44** **UCSP**					
Ballistic Coefficient	0.213					
C.O.L. Tested At	2.535"					
Speer Part No.	4463					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**55.5**	**2211**	**AA 2015BR**	**48.0**	**2089**	**AA 2230**	**51.0**	**2062**
	53.5	2132		46.0	2002		49.0	1981
H4895	**53.0**	**2119**	**Viht. N130**	**46.0**	**2078**	**IMR 4198**	**43.0**	**2041**
	51.0	2039		44.0	1988		41.0	1946
H322	**50.5**	**2104**	**IMR 4895**	**52.5**	**2074**	**Re7**	**45.0**	**2017**
	48.5	2021		50.5	1995		43.0	1927

Notes: Bold print denotes maximum loads. They should be used with caution.

45-70 GOVERNMENT (Trapdoor Rifles)

[These data are for use in original trapdoor Springfields, modern trapdoor replicas, original Sharps' Model 1874, and rolling block actions.]

Many large-caliber rimmed cartridges were developed during the last half of the 19th century. Of all these, only the 45-70 has survived. In fact, it seems to be on the rebound after years of only lukewarm interest.

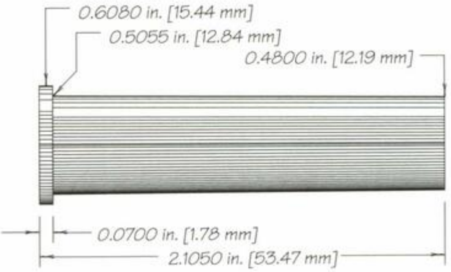
The 45-70 was first introduced in the Model 1873 Springfield rifle, also known as the "Trapdoor" for its unusual, single-shot action. Adopted by the U.S. military as the standard service cartridge, most major gunmakers in the U.S. had soon developed 45-70 sporters—usually single-shots or lever-actions. Like so many other military rifles, surplus trapdoors were sold to civilians and they were quite popular because of their low price.

The cartridge was a success both as a hunting and target cartridge. The first military ammo was loaded with a 405 grain lead bullet. Later a 500 grain version was developed to give better long range accuracy in the rifle. The 405 grain bullet was retained with a reduced powder charge for the light-weight cavalry carbines. Many years later, sporting ammunition was offered with a jacketed soft point bullet.

The Speer 400 grain soft point is the best choice for the low velocities of trapdoor loads. The 350 grain Hot-Cor soft point is a tougher bullet designed for expansion at velocities over 1900 feet/sec and may not expand at trapdoor velocities. Crimping is not necessary in single shots, although we developed these loads using a crimp. Accuracy with jacketed bullets in original trapdoors can vary from excellent to pathetic. The barrel-making technology in the late 1880's was not up to today's standards. Some rifles have barrels which are oversize and many trapdoor barrels are in bad condition from years of neglect.

In spite of the military success of the "trapdoor" Springfield, modern shooters must remember that original rifles are now over 120 years old and that smokeless powder did not exist in 1873. The old rifles must be treated with respect. Newly manufactured trapdoor replicas still use the old black powder action, although dimensional control and metallurgy are up to modern standards. Current 45-70 factory ammunition is loaded well under the maximum average pressure of 28,000 cup for safe use in trapdoor actions. The following loads were held to a pressure limit of 21,000 cup. Our test rifle has a 26 inch barrel instead of the usual 32 1/2 inch barrel of the service rifles. Even so, the velocities with some of the slower-burning propellants were nearly equal to those of higher pressure loads fired in the Marlin lever rifle (see next section) which has a shorter barrel.

ANY ORIGINAL TRAPDOOR SPRINGFIELD, SHARPS OR ROLLING BLOCK RIFLE MUST BE INSPECTED BY A GUNSMITH FAMILIAR WITH THESE ACTIONS BEFORE SHOOTING WITH ANY AMMUNITION.


0.6080 in. [15.44 mm]
0.5055 in. [12.84 mm]
0.4800 in. [12.19 mm]
0.0700 in. [1.78 mm]
2.1050 in. [53.47 mm]

Max. Case Length: 2.105"
Trim-to Length: 2.095"
Max. Cart. Length: 2.550"
RCBS Shellholder: #14
Barrel Length: 26"
Twist: 1-20"

Test Firearm: Custom Single-Shot
Case: W-W
Primers: CCI 200, 250

.458" Dia. **350 Grain** Sect. Density .238	**45** **Flat-SP**					
Ballistic Coefficient	0.232					
C.O.L. Tested At	2.715"					
Speer Part No.	2478					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**50.0**	**1715**	**H4895**	**52.0**	**1625**	**Re12**	**46.0**	**1575**
	46.0	1516		48.0	1459		42.0	1365
Viht. N133	**48.0**	**1700**	**IMR 4198**	**36.0**	**1608**	**IMR 4759**	**30.0**	**1463**
	44.0	1474		32.0	1421		26.0	1374
IMR 4064	**55.0**	**1633**	**IMR 3031**	**52.0**	**1585**	**IMR 4227**	**29.0**	**1445**
	51.0	1512		48.0	1390		25.0	1271

Notes: Bold print denotes maximum loads. They should be used with caution.

.458" Dia. **400 Grain** Sect. Density .272	**45** **Flat-SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.540"					
Speer Part No.	2479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**59.0C**	**1799**	**Re7**	**45.0**	**1681**	**IMR 4064**	**51.0**	**1502**
	55.0	1668		41.0	1493		47.0	1391
Viht. N133	**47.0**	**1750**	**AA 2015BR**	**46.0**	**1620**	**IMR 4198**	**34.0**	**1352**
	43.0	1518		42.0	1432		30.0	1195
H4895	**53.0C**	**1711**	**IMR 3031**	**49.0**	**1584**	**H322**	**41.0**	**1285**
	49.0	1536		45.0	1389		37.0	1086

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

45-70 GOVERNMENT (Lever-Action)

[These data are for use in newly manufactured Marlin Model 1895 rifles, Browning Model 1886 rifles, replica (not original) Sharps Model 1874 single shots, and original Winchester Model 1886 lever action and Model 1885 single-shot rifles known to be in good condition.]

Because factory 45-70 ammunition is loaded rather "soft" for trapdoor actions, it does not give a true picture of the capabilities of the cartridge. Owners of modern actions can see a significant improvement over factory ammunition by handloading close to the SAAMI pressure limit of 28,000 cup. In spite of the improved performance, the pressures still meet current published standards.

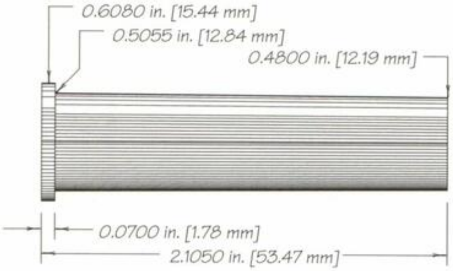
The Speer 400 grain flat soft point was used for these data. The 350 grain Speer Hot-Cor, designed for the 458 Winchester Magnum, cannot be seated to function properly through lever-action rifles.

Excellent velocities are possible using powders with moderate burning rates. When seating bullets, crimp firmly in the FRONT cannelure to hold the bullet securely in tubular magazines. Some lots of 45-70 brass have thin case mouths and you may find that separating the crimping operation from the seating operation will improve the quality of the crimp. Ammo for single shot rifles need not be crimped.

With these loads the 45-70 is powerful enough for any North American game except the large bears as long as the shots aren't too long. The construction of the 400 grain bullet is not tough enough to penetrate properly on large bears. The 45-70 is not known for flat shooting, so shots should be limited to less than 200 yards.

Many original 1885 and 1886 Winchester rifles have seen considerable use (and abuse) since they left the factory. Some may have been altered or repaired by persons of questionable competence. Have any original rifle thoroughly checked by a gunsmith familiar with these actions before attempting to fire it with any ammunition.

WARNING: DO NOT USE THESE LOADS IN ANY RIFLE ACTION LISTED UNDER THE 45-70 (TRAPDOOR) SECTION. DO NOT USE POINTED BULLETS IN ANY RIFLE HAVING A TUBULAR MAGAZINE.



Max. Case Length: 2.105"
Trim-to Length: 2.095"
Max. Cart. Length: 2.550"
RCBS Shellholder: #14
Barrel Length: 22"
Twist: 1-20"

Test Firearm: Marlin Model 1895
Case: W-W
Primers: CCI 200, 250

.458" Dia. **400 Grain** Sect. Density .272	**45** **Flat-SP**					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.540"					
Speer Part No.	2479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335*	**58.0**	**1870**	**Re7**	**49.0**	**1828**	**H322**	**49.0**	**1652**
	54.0	1722		45.0	1677		45.0	1437
AA 2015BR	**52.0**	**1865**	**H4895**	**56.0C**	**1824**	**IMR 4320**	**53.0**	**1616**
	48.0	1684		52.0	1668		49.0	1447
Viht. N133	**51.0**	**1842**	**IMR 4064**	**55.0**	**1718**	**IMR 4198**	**40.0**	**1596**
	47.0	1671		51.0	1553		36.0	1368
748*	**62.0C**	**1834**	**IMR 3031**	**53.0**	**1704**	Reduced Load **SR 4759**	**30.0**	**1351**
	58.0	1678		49.0	1541		26.0	1184

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

45-70 GOVERNMENT (Bolt-Actions, Modern Single-Shots Only)

[These data are only for Ruger No. 1 and No. 3 single-shots, the Browning Model 1885 single-shot, and M98 Mausers properly converted to fire 45-70 ammunition.]

The fact that we have three sections devoted to the 45-70 is testimony to its flexibility and popularity. This section lists loads which approach average pressures of 35,000 cup for use in ONLY the strongest actions. The top loads with the 350 grain bullet produce nearly 3700 foot-pounds of muzzle energy.

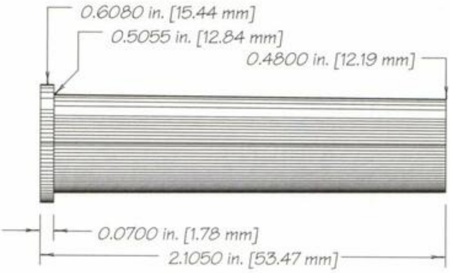
The continued popularity of the 45-70 resulted in its introduction in the strong Ruger and Browning single-shot rifles some years ago. Many custom bolt-action rifles have been built on the Model 98 Siamese Mauser action. These rifles were originally designed to handle a large, rimmed 8mm cartridge with head dimensions similar to the 45-70. The Siamese Mauser has a deep magazine, again suitable for rimmed cartridges.

For the great bears, the 350 grain Hot-Cor soft point bullet is the best choice. Its tough construction provides sufficient penetration to handle such large game. Because the velocity loss with flat point bullets is rapid, shots should be limited to 200 yards or less. The 400 grain bullet can be used for most other North American game.

In previous editions of the Speer Reloading Manual, we recommended that the 400 grain bullet be seated to the rear cannelure when used with 35,000 cup loads. This recommendation was based on the long throat in the Ruger #1 used in the Speer lab. Since Manual #11 was published, it has come to our attention that newer Rugers in 45-70 have a shorter throat and cannot chamber the 400 grain bullet unless it is seated to the front cannelure. Therefore, new 45-70 data for the 400 grain Speer bullet was developed with the bullet seated to the FRONT cannelure for a loaded cartridge length of 2.54 inches. Charges have been reduced to compensate for the deeper seating depth. The 350 grain bullet should be seated to the rear cannelure. Because of the heavy recoil, ammunition for bolt action rifles must be heavily crimped to prevent bullet movement in the magazine. Ammunition for single-shots need not be crimped.

These loads are to be used only in the firearms listed at the top of this page. Do not use them in any other 45-70 caliber firearm.

45-70 GOV'T. (STRONG ACTIONS ONLY)



Max. Case Length: 2.105"
Trim-to Length: 2.095"
Max. Cart. Length: 2.550"
RCBS Shellholder: #14
Barrel Length: 22"
Twist: 1-20"

Test Firearm: Ruger #1
Case: W-W
Primers: CCI 200, 250

.458" Dia. **350 Grain** Sect. Density .238	**45** **Flat-SP**					
Ballistic Coefficient	0.232					
C.O.L. Tested At	2.710"					
Speer Part No.	2478					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**60.0**	**2132**	**IMR 3031**	**61.0C**	**2016**	**Re12**	**66.0C**	**1956**
	54.0	1918		55.0	1818		62.0	1781
Viht. N133	**60.0C**	**2104**	**H322**	**60.0**	**2016**	**IMR 4064**	**62.0C**	**1910**
	56.0	1935		54.0	1873		56.0	1674
IMR 4198	**51.5**	**2049**	**IMR 4895**	**61.0C**	**2016**	**IMR 4320**	**62.0C**	**1881**
	46.5	1933		55.0	1834		58.0	1748
H4895	**63.0C**	**2019**	**Re7**	**50.0**	**1959**	Reduced Load **SR 4759**	**32.0**	**1507**
	57.0	1771		45.0	1905		28.0	1354

Notes: Bold print denotes maximum loads. They should be used with caution.

.458" Dia.
400 Grain
Sect. Density .272

	45 Flat-SP					
Ballistic Coefficient	0.214					
C.O.L. Tested At	2.540"					
Speer Part No.	2479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**56.0C**	**2018**	Re7	**52.0**	**1934**	IMR 4064	**56.0C**	**1761**
	52.0	1851		48.0	1752		52.0	1602
H4895	**60.0C**	**1997**	H322	**55.0**	**1927**	IMR 4320	**57.0**	**1758**
	56.0	1831		51.0	1722		53.0	1616
Viht. N133	**55.0**	**1995**	IMR 4198	**46.0**	**1814**	Reduced Load SR 4759	**32.0**	**1536**
	51.0	1832		42.0	1631		28.0	1357
H335*	**62.0C**	**1955**	IMR 3031	**54.0C**	**1786**			
	58.0	1839		50.0	1567			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

458 WINCHESTER MAGNUM

In 1956, Winchester gave American sportsmen travelling to Africa their first chance to hunt dangerous game with an factory, large-bore American rifle and cartridge. The 458 Magnum was the first in a successful series of Winchester short, belted magnum cartridges designed to function in 30-06 length actions. The first rifle for the new cartridge was the Winchester Model 70 African, a deluxe version of the standard Model 70.

The 458 was an immediate success. It turned in impressive performances on African game in spite of its compact size. Equal in power to many of the big English cartridges, the 458 has become a world standard for African hunting. Most U.S. and foreign makers now chamber rifles for the 458, which has helped it to surpass the expensive English cartridges in popularity.

Factory ammunition is loaded with a 500 grain full jacket or a 510 grain soft point bullet. Nominal muzzle velocity is around 2025 feet/sec, although production rifles may miss this mark slightly. Like other cartridges in this class, the 458 is too much gun with factory loads for North American game. However, the handloader has more flexibility by reloading lighter jacketed and cast bullets. These also help reduce recoil for more comfortable practice.

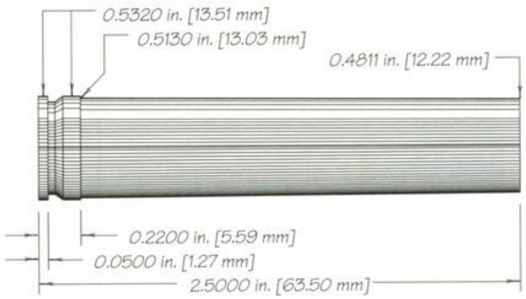
The 400 grain soft point has a relatively thin jacket. It is fine for elk and moose but we prefer the newer 350 grain Hot-Cor for most North American game including large bear. Even though it is 50 grains lighter, the 350 grain bullet normally out-penetrates the 400 grain due to its tough, heavy jacket which was designed for 458 Magnum velocities.

For the largest and most dangerous African game, stick to 500 grain bullets. Speer African Grand Slams were designed with input from professional guides. Both the soft point and the tungsten-core solid have given outstanding performance on Cape buffalo and elephant.

Reloading the 458 is the same as for any other straight-wall case. Reduced charges of the listed propellants (other than SR4759) can cause slight ignition delays. If using the ammunition in a bolt action rifle, bullets should be firmly crimped. The 400 grain Speer soft point was seated to the rear cannelure for an cartridge overall length of 3.12 inches.

Take a close look at the top velocities attained with the Speer solid. The compact construction of this bullet allows more room for propellant. This means an increase in muzzle energy of over 700 foot-pounds compared to factory ammo and handloads with other component bullets, yet loads remain within industry pressure limits.

The SAAMI maximum average pressure for the 458 Magnum is 53,000 cup. None of these loads exceed that limit.


0.5320 in. [13.51 mm]
0.5130 in. [13.03 mm]
0.4811 in. [12.22 mm]
0.2200 in. [5.59 mm]
0.0500 in. [1.27 mm]
2.5000 in. [63.50 mm]

Max. Case Length: 2.500"
Trim-to Length: 2.490"
Max. Cart. Length: 3.340"
RCBS Shellholder: #4
Barrel Length: 24"
Twist: 1-14"

Test Firearm: Ruger Model 77
Case: W-W
Primers: CCI 250

.458" Dia. **350 Grain** Sect. Density .238	**45** **Flat-SP**					
Ballistic Coefficient	0.232					
C.O.L. Tested At	3.105"					
Speer Part No.	2478					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2230*	**86.0C**	**2593**	**Viht. N133***	**76.0C**	**2471**	**BL-C(2)***	**84.0C**	**2343**
	82.0	2499		72.0	2333		80.0	2204
AA 2015BR*	**77.0C**	**2560**	**IMR 4895***	**80.0C**	**2467**	**Re7***	**73.0C**	**2335**
	73.0	2419		76.0	2331		69.0	2186
H322*	**82.0C**	**2524**	**H335***	**85.0C**	**2418**	**IMR 3031***	**75.0C**	**2314**
	78.0	2399		81.0	2227		71.0	2165
IMR 4198*	**71.0C**	**2505**	**AA 2460***	**79.0C**	**2371**			
	67.0	2399		75.0	2261			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.458" Dia.
400 Grain
Sect. Density .272

	45 Flat-SP					
Ballistic Coefficient	0.214					
C.O.L. Tested At	3.125"					
Speer Part No.	2479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2230*	**82.0C**	**2429**	**Re7***	**74.0**	**2316**	**IMR 3031***	**71.0C**	**2169**
	78.0	2290		70.0	2190		67.0	2055
BL-C(2)*	**79.0C**	**2410**	**Viht. N133***	**74.0C**	**2305**	**Re12***	**78.0C**	**2058**
	75.0	2269		70.0	2174		74.0	1955
AA 2015BR*	**74.0C**	**2386**	**H4198***	**64.0**	**2231**	Reduced Load **SR 4759***	**30.0**	**1445**
	70.0	2269		60.0	2107		26.0	1262

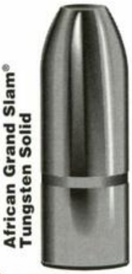
African Grand Slam®

.458" Dia.
500 Grain
Sect. Density .341

	45 AGS-SP					
Ballistic Coefficient	0.285					
C.O.L. Tested At	3.325"					
Speer Part No.	2485					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2230*	**75.0C**	**2120**	**AA 2015BR***	**68.0C**	**2075**	**748***	**80.0C**	**2007**
	71.0	2030		64.0	1977		76.0	1901
IMR 4895*	**73.0C**	**2099**	**IMR 3031***	**71.0C**	**2047**	**IMR 4198***	**61.0C**	**1994**
	69.0	1982		67.0	1944		57.0	1873
BL-C(2)*	**76.0C**	**2098**	**H335***	**75.0C**	**2022**	**Re7***	**66.0C**	**1989**
	72.0	1937		71.0	1893		62.0	1870
H322*	**71.0C**	**2076**	**AA 2460***	**71.0C**	**2020**			
	67.0	1962		67.0	1935			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.458" Dia. **500 Grain** Sect. Density .341	**45 AGS Solid**					
Ballistic Coefficient	0.277					
C.O.L. Tested At	3.340"					
Speer Part No.	2486					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2230*	**78.0C**	**2239**	**H335***	**79.0C**	**2125**	**748***	**82.0C**	**2055**
	74.0	2134		75.0	1997		78.0	1917
IMR 4895*	**75.0C**	**2167**	**AA 2015BR***	**70.0C**	**2114**	**Re7***	**68.0C**	**2051**
	71.0	2058		66.0	1993		64.0	1904
H322*	**74.0C**	**2149**	**IMR 3031**	**73.0C**	**2081**	**IMR 4198***	**62.0**	**2011**
	70.0	2035		69.0	1965		58.0	1860
BL-C(2)*	**78.0C**	**2137**	**AA 2460***	**74.0C**	**2070**			
	74.0	1986		70.0	1991			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

NOTES: RIFLE DATA

CHAPTER 12

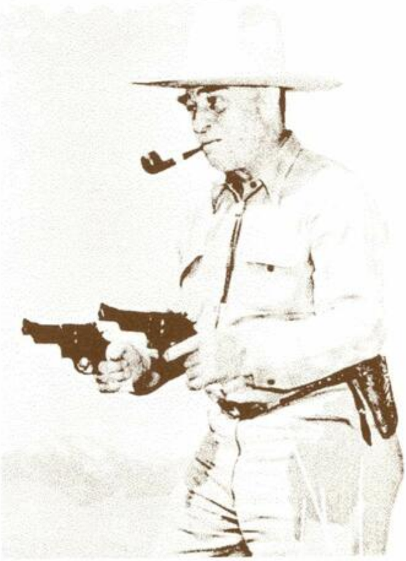
SPEER HANDGUN BULLETS: A USAGE GUIDE

Handgun shooters, enjoy many types of shooting activities that place special demands on the ammunition. Speer is committed to providing the handgunner with a choice of component bullets to cover most shooting sports.

Speer isn't a newcomer to the field of high-performance handgun bullets. In fact, Speer was the first major bullet manufacturer to provide the reloader with modern handgun projectiles— long before major ammunition companies offered similar designs.

For years, factory handgun ammunition offered a very limited choice of bullets to the shooter. For revolver cartridges, the round nose lead bullet was the standard, its form and function unchanged from the earliest days of cartridge firearms. Cartridges for auto-loaders were loaded with round nose, full metal jacket bullets which were thought to be needed for reliable feeding. Some target ammunition was loaded with flat point, or "wadcutter", bullets that cut a clean hole in a paper target for maximum score; but these loads were lightly loaded for shooting up to 50 yards. Because of the low velocities, these bullets are seldom given serious consideration for hunting or defense use.

It was private experimenters like Elmer Keith and Phil Sharpe who first suggested that the potential of the handgun as a hunting tool was being overlooked. These men found that loading the 38 Special and 44 Special cartridges with flat point bullets at high velocities (compared to the factory ammo of the time) made a real difference in terminal performance on game. Their bullet designs were offered by mould makers and the shooter had to buy moulds and cast his own bullets from lead alloy.



Elmer Keith

Other researchers, including Jim Harvey of Lakeville Arms, realized that the velocity potential was even greater with lighter bullets and that softer alloys of lead would give explosive expansion for lighter game and varmints. Harvey developed two versions of light, expanding bullets. The Prot-X-Bore was a soft lead bullet with a rigid zinc washer cast onto the base to resist gas cutting and leading. The Jugular bullet was cold-swaged with a partial copper jacket. In both designs, soft lead still contacted the bore and leading often occurred unless careful loading techniques were observed.

The high-performance handgun cartridge remained in the realm of the small shop owner or the home bullet caster. Many handgun reloaders did not have access to these bullets through normal channels. In 1958, Vernon Speer began commercial production of a "half-jacketed" revolver bullet that closely followed the original Harvey Jugular design. Within a year, this bullet was replaced with a superior Speer design that incorporated a longer jacket with a patented edge design which prevented the lead core from contacting the barrel. This design was offered in .357" and .429" diameters for the 38 Special, 357 Magnum, 44 Special and the 44 Magnum. Both hollow point and soft point designs were produced. Later, bullets of similar design were developed for the 41 Magnum. These accurate, game-getting bullets proved extremely popular and are still in the Speer line today, in spite of the many newer designs that have been developed.

As you can see, Speer has always been a leader in the handgun bullet field. With modern technology, Speer has continued to provide the handgun shooter with high-quality, high-performance bullets. Today, Speer has nearly 70 different handgun bullets in calibers from 25 to 50.

Speer Jacketed Handgun Bullets

SPEER UNI-COR® Jackets Built One Molecule at a Time

UNI-COR is Speer's unique production technique for manufacturing jacketed pistol bullets that offers the shooter new levels of bullet integrity and accuracy. Traditionally, bullet jackets are made in one operation and later combined with a lead core to create a finished bullet with two distinct parts. Speer's UNI-COR bullets incorporate a process that builds a true jacket through the electro-chemical bonding of pure copper to a lead core. This bond makes core-jacket separation virtually impossible.

All UNI-COR bullets begin as a swaged lead core. The core alloy is chosen for the specific use of the bullet. Expanding bullets have a soft lead core and a harder core is used for target bullets. After swaging and cleaning, the cores are placed in a computer-controlled electro-plating system to receive the copper jacket. Jacket thicknesses range from 0.007 inch to 0.022 inch, depending on the particular bullet. Because of the electro-chemical bond of the UNI-COR process, jackets can be thinner yet give better bullet integrity than conventional bullets with much thicker jackets. The result is better accuracy, more reliable expansion in hollow point and soft point designs combined with incredible weight retention through the range of handgun velocities.

After receiving the jacket material, all UNI-COR bullets go through a second swaging operation insuring sharp, square bases, in addition to forming other features such as hollow points or sharp semi-wadcutter shoulders where required. This process also allows very precise diameter control.

UNI-COR bullets have been put through testing that is tougher than anything the hunter will encounter. One test involved firing a 9mm UNI-COR bullet across the edge of a steel plate. The bullet was cut completely in half at 1150 feet/sec, yet the jacket and core remained firmly attached.

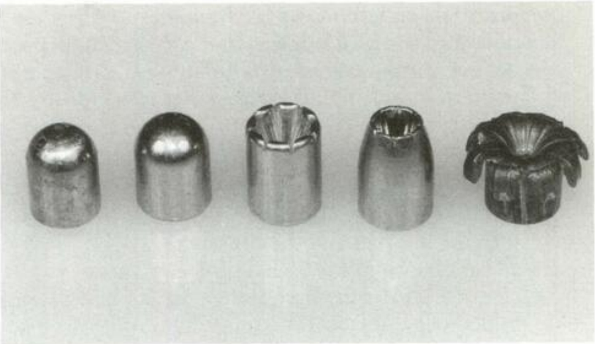
SPEER Gold Dot™ Hollow Point Bullets

Hollow point handgun bullets were developed to transfer more of the bullet's energy to the target and to reduce the frequency of bullets completely penetrating the primary target. Hollow point design lets a bullet increase its diameter upon impact.

Speer's newest handgun bullet line is Gold Dot™. Gold Dot is a premium hollow point bullet designed to meet the tough standards for handgun performance set by the Federal Bureau of Investigation. Each bullet is fine-tuned to give optimum expansion and penetration for its intended velocity range. UNI-COR technology allows Speer to offer the only mass-produced hollow point

Gold Dot Hollow Point

handgun bullet with a true bonded core. This construction allows Gold Dot bullets to pass through barriers yet function normally when it reaches the target.



Gold Dot— the manufacturing stages.

Gold Dot hollow points typically retain weight in excess of 95 percent when fired into ordnance gelatin. The pure copper jacket ensures good expansion even at relatively low velocities. Separation of core and jacket so common with other makes of bullets is a thing of the past with Gold Dot. Because the core cannot slip in the jacket, the expanded bullet holds together for excellent penetration.

Gold Dot technology allows Speer engineers the flexibility to design bullets for many applications. One important feature is pre-forming of the hollow cavity. The initial cavity is very large, and formed with a series of pleats or folds in its surface, establishing the working surface area of the cavity. After final forming, the folds are not visible yet remain as shear lines in the lead core. As the bullets expand, these folds reappear to allow optimum expansion and weight retention. The depth of the folds is important in meeting the stringent barrier penetration requirements of law enforcement test procedures.

Speer also manufactures conventional hollow point bullets for both pistols and revolvers. Speer's knowledge of rifle bullet construction was used to apply the tapered jacket design to handgun bullets. This internal jacket taper limits jacket roll-back resulting in better penetration and less chance of a core-jacket separation.

SPEER Jacketed Soft Point Bullets

The soft point handgun bullet is similar to the jacketed hollow point but the hollow cavity is omitted. Because the soft point has less surface area at the tip compared to a hollow point of the same weight and caliber, it requires higher velocity to fully expand. This is an advantage in high-velocity handgun cartridges. Soft points begin to function very well when velocities exceed 1300 feet per second. At the same speed, a hollow point may expand too much resulting in excessive weight loss or shallow penetration. For this reason the soft point is often the best choice when taking a high-velocity handgun into the hunting field. Even though a soft point will not usually give the expansion of a hollow point, it will increase its frontal area over its original diameter, and provide the deep penetration needed to anchor larger game animals.

Uni-Cor Soft Point

Speer manufactures jacketed soft point bullets using both the Uni-Cor process and conventional techniques, including the Uni-Cor 300 grain soft points in 44 and 45 caliber. All offer superior weight retention and deep penetration on heavier game.

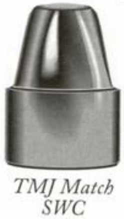
TMJ Round Nose

SPEER Totally Metal Jacketed® The Ultimate Full Jacketed Bullet

For years, full jacketed bullets were the norm for ammunition used in semi-automatic pistols. The nose is completely covered in hard jacket material to allow easy feeding in a wide variety of pistol makes and models. Although now surpassed for hunting and defense purposes by newer hollow point designs, the full jacket bullet is still popular for target shooting and informal practice.

Full metal jacketed bullets have traditionally been manufactured by forming a jacket and then inserting a lead core from the rear. This leaves exposed lead at the base along with a folded edge of jacket material. The exposed lead can be melted by the heat from the burning powder charge contributing to airborne lead in indoor ranges. Also, this vaporized lead will foul the gas vents in ported recoil compensators common in most competition pistols. Another disadvantage to traditional full jacketed bullets is that in maximum loads, the edge of the jacket edge can be lifted slightly by the expanding gases. This damage is rarely symmetrical and accuracy can suffer.

To overcome these drawbacks, Speer applied UNI-COR technology to create Totally Metal Jacketed, or TMJ, bullets. A hardened lead core is first formed and then a pure copper jacket is built up one molecule at a time through chemical electro-plating. The resulting jacket covers the entire core including the base. There are no jacket edges to be deformed by expanding gases, and recoil compensators remain lead-free. Shooters in indoor ranges will appreciate the reduction in airborne lead that the protected base affords.



TMJ Match SWC

Totally Metal Jacketed bullets are available for pistols and revolvers in most popular handgun calibers.

SPEER TMJ Match Semi-Wadcutter

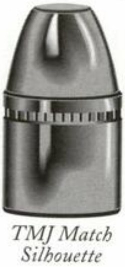
The serious competition shooter will appreciate Speer's TMJ Match bullets for the 45 Auto. Two weights are offered—a 185 grain bullet for bullseye shooting and a 200 grain combat match version for IPSC/USPSA events. Both bullets feature a sharp shoulder for clean, full-caliber holes in paper targets and a long nose for reliable feeding. In the loading data for the 45 Auto, powder charges for the 185 grain bullet are held to the velocities of typical 45 match ammo. The 200 grain bullet is loaded to make IPSC major power factor (weight x velocity = 175,000).

SPEER TMJ Silhouette Match

Metallic silhouette competition, whether sanctioned by the International Handgun Metallic Silhouette Association (IHMSA) or the NRA, is one of the most popular forms of handgun competition. Powerful, accurate handguns are needed to knock down the heavy 200 meter steel target. Bullet design is important, too. For the silhouette shooter, the Speer TMJ Silhouette Match series fills the need for an accurate, tough bullet to stand up to the heavy steel targets use by IHMSA.

TMJ Silhouette bullets start with a hard lead core, swaged from a 3% antimony-lead alloy. The thickest jacket of any UNI-COR bullet, up to 0.022 inch, is applied. The bullets then go through a second swaging operation to form the correct point shape for excellent retained velocity and to insure the base is absolutely square with the axis of the bullet. Bullets are cannelured for secure crimping, and they feature an auxiliary crimping shoulder for additional flexibility in loading.

These specialized Speer bullets have earned a well-deserved reputation for accuracy and plate-toppling power. The tough, fully encased lead core resists deformation longer and the core material remains against the target longer. Unlike conventional full-jacketed silhouette bullets, Speer's version won't extrude lead through a base opening since the base is fully covered.



TMJ Match Silhouette

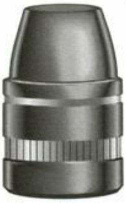
TMJ Silhouette bullets are available in .357" diameter (180 and 200 gr.), .410" diameter (210 gr.) and .429" diameter (240 gr.). Special loading requirements may be needed for the 357 Magnum cartridge depending on the model of firearm. Refer to that data for specific instructions.

Important Note on Jacketed Bullets in Revolvers

Jacketed bullets should not be used in low-velocity revolver loads except as recommended in the loading data. Jacketed bullets create more friction against the barrel wall than lead bullets and more pressure is required to overcome this friction. If the pressure is not great enough, the bullet may become stuck in the barrel causing a risk of gun damage or injury to the shooter. Because a revolver loses some gas from the barrel/cylinder gap, it cannot use the full power of the powder charge to propel the bullet.

In low-pressure revolver cartridges like the 38 Special and the 44 Special, do not attempt to reduce powder charges for jacketed bullets below the published starting load. A revolver with excessive barrel/cylinder gap or oversize chamber throats may have bullets stick in the barrel even at the published load levels. If you have any doubts concerning the gap size or chamber throat diameters of your revolver, have it checked before shooting. A barrel/cylinder gap of .008" or less is usually satisfactory.

Conventional (non-UNI-COR) rear-jacketed hollow point and soft point bullets can separate the core from the jacket in the barrel at very low velocities. The high frictional force stops the jacket in the bore, but the inertia of the heavy lead core pulls it away and exits the barrel. The resulting stuck jacket can be as damaging as a stuck bullet. Most jacketed bullets are intended for high-velocity use. If you want light loads, we recommend the use of lead bullets.



Lead Semi-Wadcutter

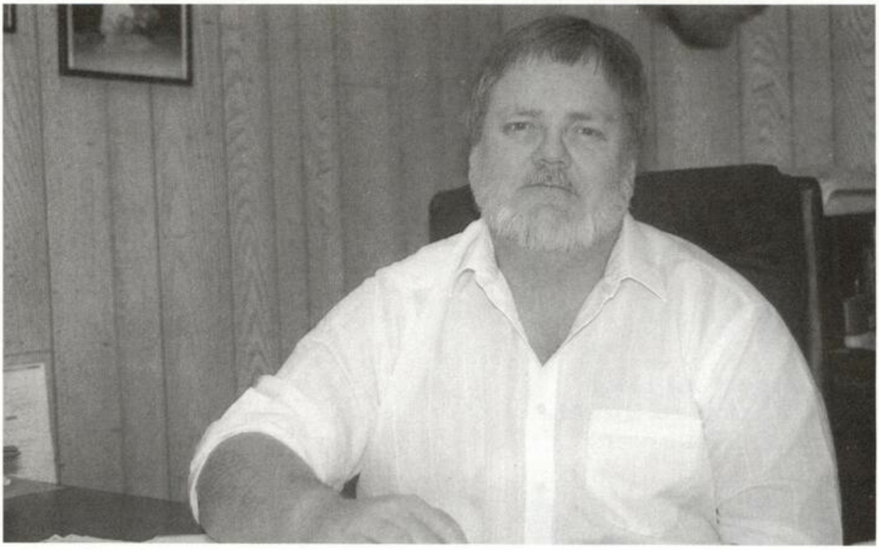
Lead Handgun Bullets

SPEER Cold-Swaged Lead Bullets

Not every type of handgun shooting calls for a jacketed bullet. Lead bullets are best for low-velocity practice loads, and, of course, lead bullets are generally less expensive than their jacketed equivalents. Before the advent of the component bullet manufacturers like Speer, the only lead bullets were those cast from molten metal. The reloader had to cast them himself or find a small, commercial bullet caster.

Vernon Speer developed lead bullets for handloaders that were formed by cold-swaging lead wire instead of casting from molten lead. This allowed high-speed production and eliminated the voids and slag pockets occasionally found in poorly cast bullets. The first version was a plain-base 38 caliber 148 grain wadcutter, which was quickly followed by the 148 grain hollow base wadcutter (HBWC). The deep cavity in the hollow base version allows the low operating pressure of 38 Special target loads to expand the base on firing giving a more effective gas seal. For target revolvers, either version works fine; for target semi-autos like the Smith & Wesson model 52, the hollow base version is mandatory and should be seated flush with the case mouth for reliable feeding.

Later, Speer expanded the line to include round nose, semi-wadcutter and semi-wadcutter hollow points in 38 caliber. A 240 grain 44 caliber SWC was also introduced along with three 45 caliber bullets—a 200 grain SWC and



Doug Glenn, CCI/Speer Centerfire Manufacturing Manager.

a 230 round nose for the 45 Auto plus a 250 grain SWC for the 45 Colt and Auto rim cartridges. Also available are a 125 grain .356" diameter round nose bullet for the 9mm Luger and a .314" diameter 98 grain HBWC for target loads in the 32 S&W Long cartridge.

Speer lead revolver bullets (except the two HBWC versions) are made with a crimping groove to permit proper seating and crimping. Lead bullets for semi-auto pistols have a shoulder at the transition from the bearing surface to the nose. These bullets should be seated so about 1/32 inch of the bearing surface protrudes above the case mouth; lightly taper-crimping the case completes the process. HBWC bullets should be seated flush with the case mouth before the case is lightly roll-crimped

Swaged lead bullets should be loaded so velocities do not exceed 1000 feet/sec. Although some firearms can propel swaged lead bullets at higher velocities without leading, Speer recommends this limit as a good compromise considering the wide range of firearms dimensions, bore finish and propellants available. If you need higher velocities, choose a jacketed bullet or look into hard-cast bullets.

Cast Handgun Bullets

Speer does not offer cast lead bullets but its sister company, RCBS, manufacturers a complete line of bullet moulds and accessories for the hobby bullet caster. Molten lead can be alloyed to greater hardness than is possible to swage on high-speed bullet production equipment. Cast bullets often have shapes that are not possible to make with swaged lead bullets. Sharp edges remain sharp because of the harder alloys. Most cast bullet designs have a generous lubrication cannelure that can be filled with large quantities of bullet lube. Hard alloys and the extra lube capacity allow full-power handgun loads to be developed with many cast bullets.

Economy also plays a big part in bullet casting. Once the cost of the casting equipment has been recovered, the major cost is the lead and lubricant. In some areas, scrap lead such as wheel weights can often be obtained for little or no cost. For maximum hardness, try linotype alloy. This mixture of lead, tin and antimony forms very hard bullets that fill out the mould cavities completely. Linotype is often available through printing shops.

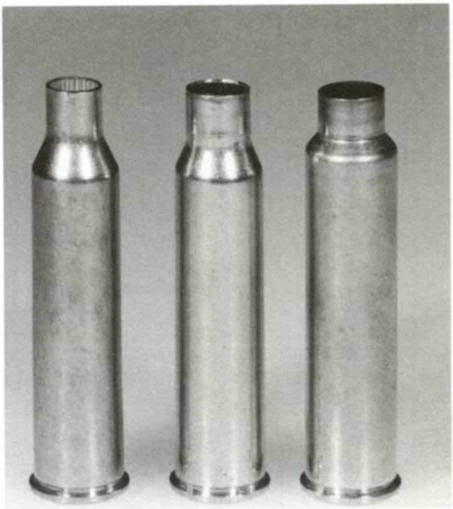
Loading cast handgun bullets is not much different from loading swaged lead bullets. If you are interested in bullet casting, we recommend that you obtain a copy of the RCBS Cast Bullet Manual.

Rifle Cartridges in Handguns

Single-shot hunting handguns such as the Thompson/Center Contender and the Remington XP-100 have become very popular in the last two decades. These pistols are as accurate as most hunting rifles and generate surprising velocities considering their barrel lengths. Bullet selection for these cartridges must be matched to the expected velocity levels. A tough bullet like the Grand Slam may give minimum expansion at handgun velocities. With some exceptions, choosing one of the lighter bullets will keep the velocities high enough for reliable expansion.

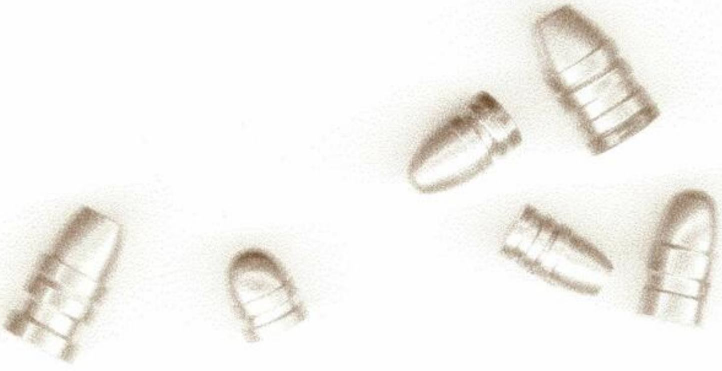
For the 22 caliber centerfire cartridges like the 221 Fireball and the 223 Remington, the Speer 50 grain TNT hollow point is an excellent choice for varmint hunting. Its design allows reliable expansion at velocities as low as 1800 feet/sec. The larger diameter TNT bullets are also excellent varmint bullets in the appropriate cartridges.

For the 7mm cartridges like the 7mm Remington BR, the 7mm T/CU and the 7-30 Waters, the Speer 120 grain Hot-Cor spitzer is a good bullet for small deer. The 30 caliber handgun cartridges work well with the 130 grain flat point for the similar size game. Larger deer can be taken with the 145 grain 7mm bullet or the 150 grain 30 caliber.



Case Forming—A 225 Winchester case (l) is modified by neck expansion and fire-forming to make the 6.5 JDJ (r).

We are often asked if the various Speer rifle bullets will expand at handgun velocities. Most Speer rifle bullets will mushroom to some degree at velocities as low as 1700 feet/sec. If you are shooting at these speeds, the flat point and round nose bullets often give better expansion than spitzers because of their greater frontal area.



CHAPTER 13

RELOADING HANDGUN CARTRIDGES:

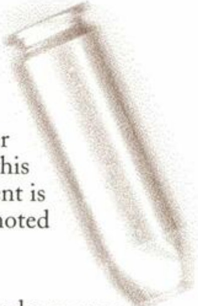
[A Step-by-Step Guide]

NOTE: If you have not yet read Chapter 7 on reloading rifle cartridges, please do so before proceeding. There are more similarities than differences between rifle and handgun reloading, so the background information in that chapter will be useful in better understanding the loading of handgun cartridges.

Many shooters start reloading for handgun cartridges before they move on to rifle loading. Economics often play a major role when choosing to reload for handguns because shooters generally fire more handgun cartridges in a session than rifle rounds. A session at the rifle range may involve shooting less than 20 rounds; however, a session at the pistol range may require 100 rounds or more. Because of the sheer volume of ammunition required, handgun shooters need a cost-effective yet reliable source of ammunition. Unless you're rich, reloading is the best solution.

There are other reasons to load handgun cartridges. Cartridges like the 44 Magnum produce heavy recoil with factory ammunition, but can be handloaded with lighter bullets and powder charges for practice. The handloader has access to a variety of bullet weights and designs that are not available in the factory made ammunition. Custom tuned ammunition is thus available to the handgunner, just as it is to the reloading rifleman.

Another factor is improved ballistic performance. Some cartridges developed decades ago for weaker firearms are now chambered in modern versions that can stand substantially higher pressures. Where this type of improvement is possible, we have noted it in the cartridge introduction.



Because most handgun cases are straight-wall designs, loading them is very similar to a rifle case of the same design. The case must be inspected and then resized to allow proper chambering. Straight-wall cases are neck-expanded and flared in another operation. Next, the case is primed and then charged with propellant. Bullet seating and crimping, followed by final inspection, complete the reloading operation.

Like their rifle counterparts, straight-wall handgun cases require three reloading dies. Bottleneck handgun cartridges like the 7mm Remington BR and the 221 Remington Fireball are loaded like bottleneck rifle cartridges, so a two-die set is used.

Many high-volume handgun shooters now choose to load on progressive or semi-automated equipment. With this sophisticated reloading equipment, a reloader can safely produce several hundred rounds per hour. The quality of the ammunition is just as good as that loaded on single-stage equipment. However, the greater

mechanical complexity of the progressive press requires special attention and some experience on the part of the operator. Before using progressive equipment, please read Chapter 9, "Automating the Reloading Process".

— Step 1 —
Read the Equipment Instructions

Just as in rifle cartridge reloading, it is important to understand how your hardware works. Time invested in study now will help avoid headaches and safety hazards later.

— Step 2 —
Case Cleaning
(optional)

See Chapter 7 for information on cleaning your cases.

— Step 3 —
Case Inspection

As with rifle cartridges, handgun cases should be inspected for defects before loading. This operation is easier if the cases are clean. Defects to look for are similar to those listed in the section on rifle reloading. Case splits in handgun ammunition are usually seen at the case mouth and seldom are longer than 1/8 inch. Even though this is not a safety hazard, these cases should be discarded because they will not allow consistent crimping and bullet pull.

Cases for semi-automatic pistols (especially the 45 Auto) may have bent case mouths from striking the slide during ejection. These cases can be reloaded but the dent should be ironed out with a tapered plug or wooden dowel before sizing. If not removed, the sizing die can cause the dent to become a sharp fold and ruin the case. Look for deformed rims in semi-auto cases. These will make inserting the case in the shell holder difficult and could cause a malfunction when fired. Cases with badly deformed rims should be discarded; however, minor burrs caused by the extractor and ejector can be quickly removed with a small, fine-cut file.

RCBS standard 3-die handgun die set

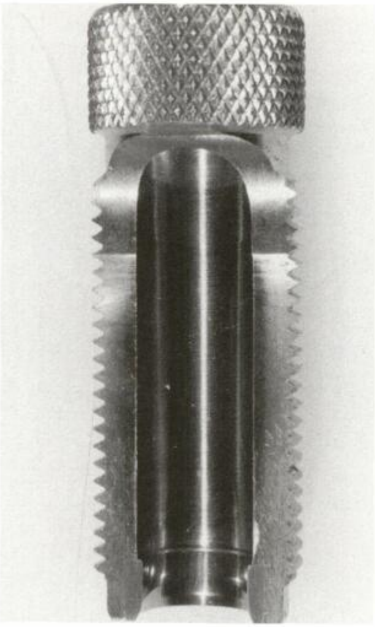
— Step Four —
Case Sizing

There are two types of sizing dies for straight-wall cases: steel and carbide. Standard steel dies are similar to rifle dies in that lubrication of the case is required before resizing. Lubricant is applied with a case lube pad in the same manner as for rifle cases. Just like with rifle dies, the sizer die is screwed into the press until it touches the raised shell holder with all play removed. After the cases are sized, you must make sure that all lubricant is removed.

Most sizer dies for handgun cartridge incorporate the decapping pin, although in older dies the decapping pin may be part of the expander die. In either case, the pin should protrude about one-quarter inch below the bottom of the die for proper decapping.

Carbide Sizing Dies

For high-volume reloaders or those of us who don't relish the extra work of applying and removing case lubricant, carbide sizing dies are a must for straight-wall handgun cartridges. The carbide insert in the steel die body is usually either tungsten or titanium carbide and the insert is the only portion of the die



Cut-away of RCBS tungsten carbide sizer die. The carbide insert is at the bottom/mouth of die.

that touches the case. Carbide inserts are hard and dense, and their highly polished finish reduces sizing force and eliminates the need for lubrication. Carbide dies produce a smooth, burnished case finish. Years ago, carbide dies were essentially hand-made and quite expensive. Demand for these premium dies resulted in manufacturing improvements to reduce production costs and RCBS passed these savings on to the reloader. Today, there is little reason to forgo the benefits of carbide sizing. The small additional cost of the carbide sizer is quickly offset in time savings and convenience, plus longer case and die life.

Adjusting the carbide die is accomplished differently from steel dies. Carbide, although very hard, is brittle. If the shell holder impacts the carbide insert, it could shatter. To prevent damage, the die should be installed in the press so that it clears the shell holder by about 1/64 inch (or about the thickness of a matchbook cover). This small clearance will insure that the die will not be damaged during use. A carbide die may leave a ring just ahead of the case rim. Although this is only cosmetic, it can usually be eliminated by backing the die out slightly until the ring is reduced. The case body still will be resized enough to permit normal chambering.

Cartridges that routinely operate at high pressure, like the 357 and 44 Magnums, stress the case more than lower pressure cartridges. Under these conditions, resizing will often produce the ring regardless of die position. Be sure to size the case far enough back to allow normal chambering. Most reloaders use new or once-fired brass for maximum loads and afterwards set the cases aside to use for lighter loads later.

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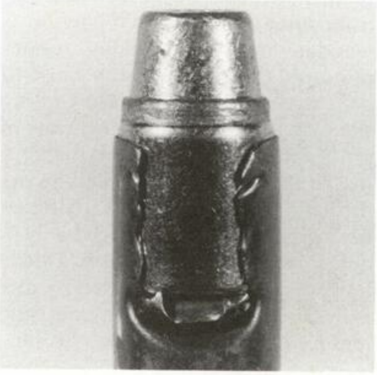
— Step Five — Case Mouth Expanding and Flaring

(Straight-wall cases)

The second die in a three-die pistol die set is a combination neck expander and flaring tool. The main body of the expander plug should be at least .001" smaller in diameter than the bullet. For heavy-recoil cartridges, the expander may be as much as .003" inch under bullet diameter to ensure the case walls firmly grip a jacketed bullet. Some reloaders keep two expander plugs for a given cartridge— one for lead bullets that is .001" undersize and another for jacketed bullets about .002" to .003" undersize.

Flaring the case mouth allows you to easily start the bullet into the case. This step is recommended for all straight-wall cases regardless of bullet type and is mandatory when



The result of too little mouth flare.

loading lead bullets. A case with little or no flare will cut into the soft alloy of the bullet and destroy accuracy. The case may also be ruined.

Excessive flare will shorten case life by causing premature mouth splits. The most effective flare is achieved using cases that are trimmed to uniform length. A "short" case (relative to the die setting) will not receive enough flare while a "long" case may be flared too much and develop mouth splits. To test for the correct amount of flare, press a bullet into the case with your fingers and slowly invert the case. If the bullet enters about 1/16 inch and stays put, the flare is sufficient.

— Step Six —
Priming

Priming handgun cases is done just as it is when reloading rifle ammunition. Therefore, you should review the priming section in Chapter 7 to refresh your memory.

As with rifle primers, CCI designed its pistol primers to give optimum sensitivity when seated .003" to. 005" below flush. Failure to follow this simple guideline can result in misfires. Most handguns do not develop the firing pin energy available in rifles, so anything in the reloading process that optimizes sensitivity will result in more reliable ammunition. Primers must be seated so that the legs of the anvil seat firmly against the bottom of the primer pocket.

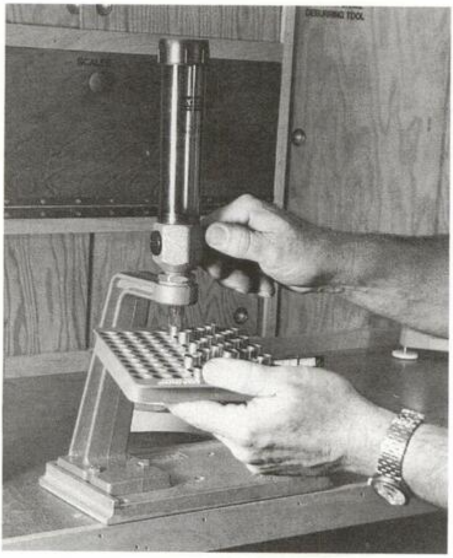
High primers can be hazardous in either semi-automatic pistols or revolvers. In semi-autos, a high primer can cause a *slam-fire*, which describes what happens when the primer is activated by the slide slamming home. Ignition can occur before the action is fully locked resulting in hot, high-pressure gases being released from the action. Slam-fires can also cause the firearm to "double", firing more than once when the trigger is pulled. Either situation is dangerous.

High primers in revolvers will often cause the cylinder to bind, jamming the firearm. A jammed revolver is difficult to disassemble and usually ends the shooting session. When you are priming, run your finger across the cartridge base to check for high primers. If detected at this stage (before charging), they can be safely reseated.

Handgun shooters seldom worry about cases with crimped primer pockets; however, they do exist. Most 45 Auto military brass has a light primer crimp which may go unnoticed. Some 38 Special military cases made in Canada (IVI headstamp) have heavily crimped primers and military surplus 9mm brass is also crimped. For safety's sake, all military 45 Auto, 38 Special and 9mm cases should be processed through the RCBS Primer Pocket Swager before loading.

Because most handguns have less firing pin energy than do rifles,

RCBS Hand-Priming Tool— A useful tool for the high-volume handgun reloader.



RCBS Little Dandy™ fixed rotor measure was developed for handgun reloading.

primers for handgun cartridges generally have thinner cups than rifle primers. Therefore, using a rifle primer in handgun ammo may cause misfires. In addition, rifle primers typically have more priming mix than handgun primers, and can cause higher (and potentially dangerous) pressures if substituted. However, rifle primers are used for cartridges designed for rifles but later adapted to handguns like the 223 Remington, or for certain high-pressure handgun cartridges like the 357 Maximum and 454 Casull. Follow the recommendations of the loading data to guide you in your choice of primer.

CCI Magnum primers are recommended for charges of slow-burning propellants in large cases. Loads using propellants such as Winchester 296 and Hodgdon H110 were developed with magnum primers as indicated in the data. The magnum primer's longer flame duration insures complete ignition especially in low temperatures. Use magnum primers only when recommended in the data.

Because of the volume nature of handgun reloading, the RCBS Automatic Priming Tool is a popular accessory. In addition to speeding the loading operation, the tool allows the reloader to keep primers free of contamination from oils on the hands. For a review of priming tool types, see the section on "off-press priming" in Chapter 7.

— Step Seven —
Powder Charging

Because there are so many choices of handgun propellants, you need to carefully consider how you plan to use your handloads load before choosing a powder. For light target loads, the "faster" propellants are the best choice to achieve uniform velocities, top accuracy and clean burning. Hercules Bullseye is a popular and economical propellant which can be used in most target loads. Other powders such as Winchester 231, Accurate Arms #2, and Hodgdon HP-38 perform equally as well.

Mid-power loads call for propellants with a "medium" burning rate. There are a number of shotgun propellants that function very well in these loads, such as Hercules Unique and Hodgdon Universal Clays, plus handgun propellants like Winchester Action Pistol and Accurate Arms #5. For the heaviest loads and top velocities where the cartridge and gun design permits such power, the slow burning propellants like Winchester 296, Hodgdon H110, Hercules 2400, VihtaVuori N110, IMR 4227 and Accurate #9 are excellent candidates. Relatively heavy charges of these powders are required, but the large volume of gas produced accelerates the bullet to top speed while staying within safe pressure limits.

Slow burning propellants should not be used for light loads, particularly in large cases. These powders operate most efficiently at fairly high pressures. At lower pressures or when significant air space remains in the case, they are dirty burning and the charge may fail to ignite completely causing a bullet to stick in the bore. This may damage the firearm, and can cause personal injury if another bullet is fired into the obstructed barrel.

As with rifle cartridge reloading, the handgun reloader NEVER starts with a maximum load. Use the starting load and work up as your shooting tests indicate that the loads are safe. If you detect any pressure signs, STOP. You have reached the maximum for your firearm.

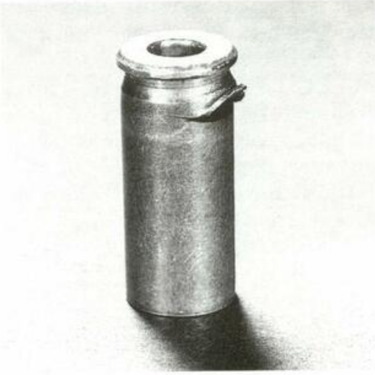
We discussed pressure signs in general in Chapter 5, "Velocity, Energy and Pressure." In revolvers, one warning of excessive pressure is "sticky" extraction of the case from a revolver's cylinder. Although other factors such as soft cases or rough chambers can cause poor extraction, this combined with badly flattened primers probably indicates that you have passed the "safety zone" for your revolver.

WARNING— UNDER NO CONDITIONS SHOULD YOU EXCEED THE MAXIMUM LOADS SHOWN!

When loading small charges of quick-burning powders, you must be careful to avoid over-charging a case. These charges occupy very little space, so it's possible to get two or more in a case. Reloading rifle ammo seldom poses this hazard because the powders are fairly bulky and a double charge would normally (but not always) overflow the case.

A "squib" load is one in which there is a light or missing powder charge, or one where an otherwise normal charge fails to burn completely. A squib load may drive the bullet just far enough into the rifling to cause a dangerous bore obstruction. This condition can also occur when a light target load is fired in a revolver with excessive barrel-cylinder gap. Too much gas is lost through the oversized gap and the next cartridge fired can drive its bullet against the stuck bullet causing damage to the firearm. Jacketed bullets should not be used in light loads, especially in revolvers. The addition friction against the bore can cause a bullet to stick or to cause the lead core to separate from the jacket. In either circumstance, a dangerous bore obstruction occurs.

Normally, the shooter should detect the greatly reduced report and light recoil of a squib load. If this occurs, stop shooting and clear any remaining ammunition from the firearm before removing the obstruction. However, during rapid-fire shooting or when shooting on a busy range, you may not hear the squib. Preventing squib loads and the double charge by careful loading techniques is the best insurance against gun damage and personal injury.



A deliberate overload blew out this 38 Super case at the feed ramp.

A good technique for preventing charging problems is using two loading blocks. Place one on each side of the powder scale or measure. Primed, empty cases are placed mouth down in one block. Pick up a case, charge it with powder and put it in the block on the opposite side. After all are charged, visually check EVERY case to make certain that it contains one— and only one— powder charge before seating *any* bullets.

It is a common practice when using a powder measure to pass the entire loading block containing the primed cases under the mouth of the measure, charging each case in turn. If you use this method, develop a uniform pattern of motion, both for positioning the block and operating the measure. Again, when finished, visually inspect every case. Inspecting large cases that contain only a small powder charge requires a strong light source. WITH EITHER METHOD, DO NOT SEAT BULLETS

UNTIL ALL CASES HAVE BEEN CHARGED AND VISUALLY INSPECTED.

Because of the high volume of handgun cartridges often loaded at one time, the powder measure is a real time saver for the reloader. If your adjustable powder measure has interchangeable drums, select the smaller size for more accurate metering of small charges. Current RCBS Uniflow powder measures come with a special metering screw shaped to accommodate small as well as large charges, so no change-over is required. Because many handgun reloaders develop and stick to one basic load, say 2.7 grains of Bullseye for a 38 target load, a fixed-cavity measure like the RCBS Little Dandy™ is often used. Twenty-six different rotors are available for the Little Dandy, each calibrated for specific charges of the popular pistol powders.

Powder charging should be done at a leisurely pace with frequent inspection to ensure safe reloaded ammunition.

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— Step Eight —

Bullet Seating and Crimping

Seating bullets and crimping (as required) completes the loading process. Bullet seating depth is fairly critical to proper function in handguns. In revolvers, the cylinder will not rotate if the bullet is seated so long that it protrudes from the cylinder. In semi-auto pistols, feeing will be unreliable if the cartridge is too short yet an overly long cartridge may not fit the magazine, or wedge in the origin of the rifling. In small capacity, high-pressure cases like the 9mm Luger, excessively deep-seated bullets will raise pressures to potentially unsafe levels. The cartridge overall length which Speer technicians used for testing is shown for each load.

If you are loading a bullet with a crimping cannelure, the proper seating length will be achieved by seating to this point. Ammunition for revolvers is roll-crimped into the crimping cannelure; ammunition for semi-automatic pistols is either taper-crimped or receives no crimp at all. Crimping a revolver cartridge is important for proper performance. An uncrimped bullet can unseat due to recoil when other cartridges in the cylinder are fired. If the bullet moves enough, it can tie up the cylinder or its ballistic performance will change. Certain bullets like the Speer 44-300 and 45-300 grain UNI-COR™ soft points have two cannelures. Refer to the loading data to determine the correct loading length.

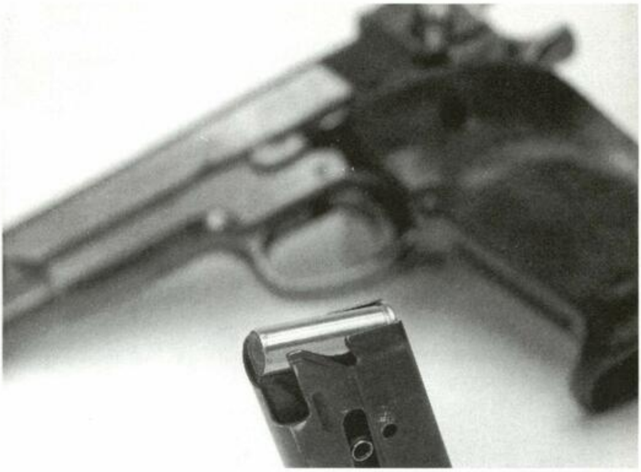
The seater die consists of a die body and a bullet seater plug. Each is supplied with a lock ring to preserve its setting. The crimping shoulder is machined into the die body. The position of the seater plug relative to the shell holder determines the bullet seating depth; the position of the die body relative to the shell holder determines the amount of crimp.

Adjustment for Seating and Roll Crimping

To set the proper seating depth for a revolver bullet, raise the ram to its highest position and screw the seater die into the loading press, leaving the die body about a quarter-inch away from the shell holder. Screw the lock ring on the die body down against the press but do not tighten the set screw. Lower the ram and put a bullet on the mouth of a charged case and place it in the shell holder. Raise the ram and the cartridge enters the die. Continue raising it until you feel a slight resistance. The bullet is now starting to seat into the case.

Check to see how far the bullet has been seated. The bullet needs to be seated so that about 90 percent of the crimping cannelure is covered by the case. If the bullet needs to be seated deeper, adjust the seater plug and raise the ram. Check the depth again and repeat the process until the bullet is properly positioned. Unscrew the seater plug as far as it will turn and go on to the next step.

To set the crimp, loosen the die body lock ring and raise the ram to its highest point, leaving the cartridge in the shell holder. Slowly screw the die into the press until you feel a slight resistance. The crimp shoulder is now touching the case mouth. Lower the ram slightly and screw the body in about a quarter turn. Raise the ram fully and check the crimp. Continue until you achieve the desired crimp, then tighten the lock ring on the die body against the press. With the ram at its highest point and the cartridge fully in the die, screw the seater plug into the die body until you feel it touch the bullet. Tighten the seater plug lock nut and the die is now set for simultaneous seating and crimping. This setting procedure works for all RCBS handgun dies and those of similar design. If you have dies of a different brand, read the instructions from the die manufacturer for the proper seating and crimping procedure.



Match hollow-base wadcutters must be seated flush for proper feeding in semi-autos.

How much crimp is enough? Several factors are involved. When using slow burning propellants, a heavy crimp helps insure that the propellant ignites completely, permitting higher velocities and cleaner burning. Light target loads need not be heavily crimped; lightly crimping the case mouth is adequate to prevent bullet jump and gives a "finished" edge for easier chambering.

Seating and Taper Crimping for Semi-Autos

Most ammunition for semi-automatic pistols headspaces on the case mouth. If pistol ammunition is roll crimped, the case mouth is not firmly supported against the blow of the firing pin and misfires or poor accuracy may occur. Instead, taper crimping is required for cartridges that headspace on the case mouth.

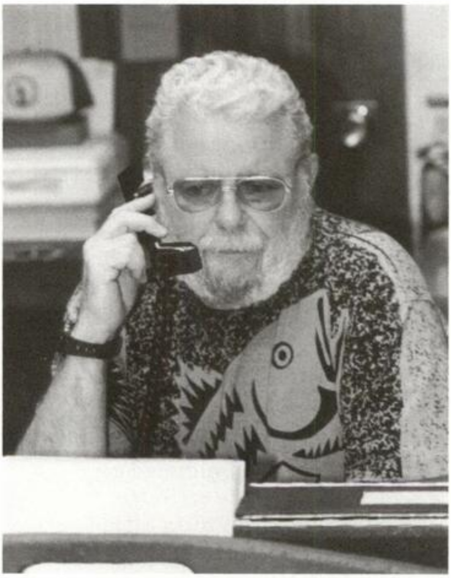
Taper crimping lightly swages the case mouth and part of the case body into the bullet to provide a tight grip, yet still leaves enough of the case mouth exposed to permit proper headspacing. Instead of the sharp crimp shoulder found in roll crimp dies, the taper crimp die has a shallow-angle shoulder that performs the necessary forming.

In the past, the taper crimper was a separate die, resulting in a four-die set. Current RCBS bullet seating dies for pistol cartridge are made with the taper crimp feature for easier use in progressive loading equipment. Independent tests have shown this system for simultaneous seating and taper crimping usually provides better accuracy than the older system of seating and crimping in separate operations.

Bullets intended for semi-automatic pistols typically do not have a crimping cannelure. Proper seating depth depends on the individual firearm and its magazine. However, industry standards for maximum and minimum cartridge dimensions take gun variations into consideration. Unless otherwise noted, the data in this manual were developed at cartridge lengths within industry specifications, and the cartridge length used for each load is listed.

Setting the seating depth and taper crimp for a semi-auto pistol cartridge is accomplished by adjusting the seating die like the method for revolver cartridges. Because there is usually no crimping cannelure on the bullet, the length must be carefully checked with a caliper. Once the bullet is seated to the proper depth, setting the taper crimp is accomplished in a manner similar to setting the roll crimp for revolver cartridges. Taper crimping will remove the flare from the case mouth for more reliable feeding. Excessive taper crimping can actual resize the bullet and cause poor accuracy.

To verify that your handloads have the proper taper crimp and seating depth, unload the pistol, disassemble it and remove the barrel. Drop a factory cartridge in the chamber and note the position where the cartridge stops. Remove the factory cartridge and drop in a handload. Does it stop where the factory cartridge did? Apply thumb pressure to the case head and turn the barrel muzzle-up. Does the handload fall free or does it stick? If it sticks, note the position. A cartridge that sticks in the chamber further out than the factory cartridge means the case has too much flare or the bullet is seated too long and has jammed in the rifling. A cartridge that sticks in the chamber and is further in than the factory cartridge has too much crimp. A cartridge that enters the chamber further than the factory cartridge but does not stick probably has a short case.



Jay Postman, RCBS Technical Service Manager

Either extreme is unsatisfactory. Too long means the cartridge may jam or fire at unsafe pressures; too short means it may misfire or be inaccurate. Bullet seating and crimping must be done correctly for reliable performance.

In cartridges which headspace on the case mouth, the case can actually shorten after many firings. This is due to the blow of the firing pin pushing the case into the chamber shoulder and peening the case mouth. Normally this shortening is not a problem, but for critical target work, cases should be of uniform length and within industry specifications.

When seating Speer 45 caliber bullets such as the 200 grain lead semi-wadcutter (SWC), the 230 grain lead round nose, and the 185 and 200 grain Uni-Cor TMJ semi-wadcutters, leave the shoulder of the bullet exposed about 1/32 inch. This seating position gives improved function, particularly with the lead SWC bullet.

There is a wide variation in handgun bullet profiles. Using a seater punch that is the wrong shape will deform the bullet nose. RCBS die sets for revolver cartridges include seater plugs for wadcutter, semi-wadcutter and round nose bullets. Die sets for semi-auto cartridges have seater plugs for semi-wadcutter and round nose bullets. If none of these plugs fit the profile of the bullet you plan to load, RCBS will adjust theirs free of charge if you send them the plug with five sample bullets. If you are using a different brand of die, contact the manufacturer for assistance.

A temporary fix to a seater plug misfit is to melt sealing wax (available at most stationery stores) into the seater plug and then press the nose of the bullet into the wax before it hardens. Also, a small ball of thin aluminum foil can be pushed into the seater plug and positioned by seating the first bullet. The foil contours to the bullet nose and should last for a box or two of ammunition.

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Tech Tip: When seating lead bullets, lubricant can build up on the seater plug causing successive bullets to seat deeper. Check the seating depth every 20 cartridges to see if the depth is changing. If so, remove the die from the press and clean the lube out with a spray degreaser like Outers Crud Cutter®. A *very* thin film of light oil or release compound in the seater die and on the plug will help slow the build-up. Don't over-lubricate!

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— Step Nine —

Final Inspection and Identification

Just as the big commercial makers inspect their ammo, you should also. Before boxing, lay the cartridges on a light-colored cloth and roll them around, giving each a careful examination. Look for bulged, torn or split cases, damaged bullets, varying seating depths, irregular crimps and missing primers. When you box the ammo, check once more for high primers. HOWEVER, REMEMBER THAT RESEATING A HIGH PRIMER IN A LOADED CARTRIDGE IS EXTREMELY HAZARDOUS AND MUST NOT BE ATTEMPTED. Set any cartridges with high primers aside for later disassembly and rework.

Ammunition loaded with lead bullets may have excess bullet lubricant on the outside that should be wiped off before boxing. If not removed, the lubricant on the case can cause extra strain on the firearm because the case won't adhere to the chamber walls during firing and will thrust harder against the breech.

Before quitting, make sure that all necessary load information is on the ammo boxes. If you are keeping a log, update it at this time.

Special Considerations for Semi-auto Pistols

Because the semi-automatic pistol uses the energy from the fired cartridge to operate the action, ammunition that closely matches the velocities of factory ammunition usually functions best. Very light loads may cause feeding and/or ejection problems because there is not enough energy to operate the mechanism. Heavy loads may accelerate wear on the pistol.

A major factor in pistol wear is slide velocity. The speed at which the slide moves rearward during firing is directly proportional to the velocity of the bullet. Even though a load produces normal pressures, if bullet velocity is significantly higher than similar factory ammunition the slide velocity can exceed the gun's design limits and battering of the pistol can occur. It is best to keep velocities within the range of factory ammunition.

Low velocity target loads usually function best when the faster-burning powders are used. The sharp impulse of these powders allows the action to operate normally with relatively light loads. Because every firearm is different, you may find that the lighter loads listed may not cycle your pistol. Increasing the powder charge gradually toward the maximum will eventually result in a load which functions reliably. Very slow-burning powders may cause sluggish functioning.

Taper crimping is best for any cartridge for semi-auto pistols. Some cases like the 38 Super Auto are semi-rimmed and, in theory, headspace on the rim. However, this rim is small and there is some variation in dimensions among different brands of cases. Thus, the rim may not control headspace properly. Choosing the taper crimp over the roll crimp insures positive headspace control.

Cartridges for semi-automatic pistols must resist the bullet being pushed into the case during feeding. Normally, a properly sized expander plug and a firm taper crimp will provide enough resistance. Test the cartridge by pushing the tip into the edge of a wooden bench. If the bullet moves, you need to correct the situation before loading any more cartridges. Case wall thickness often varies considerably. If you are sure that your expander is the correct size but bullets are still loose, try cases of a different brand to see if the setback problem can be eliminated.

9mm Luger Suggestions

The 9mm Luger cartridge was not widely reloaded prior to the 1980's. However, the growing popularity of this cartridge has led to more reloading. Here are some suggestions for better 9mm reloads.

The 9mm case is rather small compared to other high-performance pistol cartridges. Propellant space is limited and any variation in capacity among brands may create wide variations in pressure, velocity and function. Before reloading, sort your cases by headstamp. Mixed cases not only cause ballistic variations but can lead to loading problems. Neck expansion, bullet seating and crimping operations can all be adversely affected by mixed cases. Sorting cases will give the best overall results.

The groove diameter of 9mm barrels varies from .354" to over .357" but the SAAMI maximum bullet diameter is .3555". The accuracy potential of your pistol depends on how well bullets match the bore diameter. Speer 9mm jacketed bullets are built to the top of the SAAMI specification and are quite accurate in most pistols.

The Speer 125 grain lead bullet is .356" in diameter to reduce leading in oversize bores; however, you should limit the velocity of this bullet to 1000 feet/sec or less to insure best accuracy. Usually the most accurate lead bullet load is the one that just cycles the action of your pistol.

Subsonic loads (those which do not exceed the speed of sound) with the 147 grain bullets are best loaded with a powder having a medium burning rate, such as Unique, Winchester 540, HS-6 and AA #7. These powders generally give better accuracy with heavy bullets than faster powders.

In the loading data, the cartridge overall length we used for each type of bullet is listed. You must not seat bullets deeper than this without reducing the powder charge. The limited case capacity of the 9mm means that a deep-seated bullet will increase pressures dramatically.

Short 9mm bullets such as the Speer 100 grain hollow point may not feed in some pistols, even with the bullet seated as far out as practical. This varies among pistol makes. If this occurs, the best solution is to switch to a bullet with a longer nose, such as the 115 grain Gold Dot.

At the Range

Well, it's time to test your reloads to see how they shoot. As with rifle testing, small groups are more important than point of impact. However, many handguns have fixed sights or sights that are adjustable for windage only. In this case, finding an accurate load that still hits close to point-of-aim may require more testing. Here are some suggestions for effective range testing of handgun ammo:

Safety First!

Remember your eye and ear protection. Handguns blow unburned powder from the barrel/cylinder gap in revolvers and from the ejection port in semi-autos. Well-designed eye protection keeps this residue from getting in your eyes. Handguns can be quite noisy and continued shooting without ear protection may cause immediate and permanent hearing damage.

Testing is more meaningful if you use a rest and shoot from a bench. One of the nicest handgun rests around is the Outers Pistol Perch®. The Pistol Perch allows the handgun to recoil freely, yet is steadier than most homemade devices. Sandbags can also be used, but be aware that in powerful revolvers like the 357 and 44 Magnums, the high-velocity jet of gas from the barrel/cylinder gap can cut through fabric covered bags and blow sand in your face. When shooting high-pressure revolvers over fabric bags, protect the bags with a sheet of heavy leather.

- Grip the handgun consistently for each shot. Changing your hand position or grip pressure between shots will affect the group size as well as change the point of impact. These effects are most apparent when shooting handguns with heavy recoil.

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Tech Tip: **When accuracy testing a revolver in the single-action mode, you can better maintain a constant grip by cocking the hammer for each shot with your non-shooting hand. This helps minimize the need to reposition the revolver in your shooting hand for each shot.**

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- Long shooting sessions with heavy caliber handguns are more enjoyable if you wear a padded shooting glove on your firing hand. These gloves distribute recoil and prevent soreness or chafing due to checkered grips. They are available through several shooting accessory companies.

- Firing either two 5-shot groups or one 7-shot group for each load gives a good idea of what kind of accuracy your ammunition can give. Most handgun accuracy testing is done at 25 yards. However, hunting handguns should be tested at a minimum of 50 yards and even further if you plan to take long shots.

- Relax and take your time when testing loads. Pace your shots and your breathing. Don't try to make a judgment on accuracy based on a group that you shot rapid-fire after jogging back from the 50-yard target holder!

What Kind of Accuracy Should You Expect?

This is a difficult question to answer. The industry accuracy specification for most sporting handgun ammunition is three-inch groups at 25 yards fired from a fixed barrel. A production pistol or revolver of decent quality will generally shoot this well or better if you do your part. Groups around one inch at 25 yards are great in anyone's book from the typical sporting revolver or semi-auto pistol.

However, there are handguns that will routinely shoot well under one inch at this distance. Heavy, single-shot pistols like the T/C Contender and the Remington XP-100 are closer to rifles when it comes to accuracy. It isn't unrealistic to expect 50-yard groups of well under one inch with either gun. This kind of accuracy is fine for most game hunting within the power and range limitations of the gun/cartridge combination.

Regardless of what you do as a handloader, each individual firearm will have some finite limit to the tightest group size. However, a good rule of thumb is that the average handgun will shoot better than its owner (many shooters are distressed to discover this!). However, wear, damage or mistreatment can cause even the best-quality handgun to shoot poor groups.

Try to be realistic with your expectations. If you are looking for plinking loads, then three-inch groups at 25 yards will probably suffice. However, if you are like most of us handloaders, knowing that you can adjust loads to give better performance will probably have you back at the bench, looking for just a bit more accuracy.

"WHY BALLISTICIANS GET GRAY"

by Dave Andrews

(Editor's Note: This article was originally printed in the Speer Reloading Manual #9, published in 1974. When planning the #12 Manual, it was my intention to write a new section discussing velocity variation among different firearms chambered for the same cartridge. Then I re-read Dave's article and decided that twenty years hasn't aged this information at all. Dave's insightful essay holds as true today as it did in 1974, and we still get requests for reprints. Thanks to writer Dick Metcalf for his gentle urging to reprint this.)

* * *

"Dear Ballistician: Your reloading manual is all wrong! You say on page 713 that 11.2 grains of Super-Duper powder will push the 125 grain bullet at 1468 fps. My barrel length is the same as yours, but when I tried this load and had my friend chronograph it the velocity was only 1411 fps. Why are you so far off?"

* * *

Letters like this imaginary one are all too common. In an effort to pinpoint one reason for such velocity differences, the Speer Ballistic Laboratory selected three lots of 357 Magnum ammunition in different bullet weights. These particular lots of ammunition were selected because of their uniformity, not because of high velocity. This ammunition was fired in all of the 357 Magnum guns available to the lab at the time.

The different handguns were all tested in the same manner with the gun muzzle elevated and then gently lowered to the horizontal for each shot. Every effort was made to make the results as accurate as possible.

The table shows the average velocities of the three different bullet weights in each of the guns tested. Note that in the standard 10" test barrel, made to tight ammunition industry specifications, the extreme variation (EV) in the velocities ranged from 48 fps for the 125 grain hollow point bullet, to 38 fps for the 158 grain soft point bullet. Using the 6" barreled revolvers as an example, the EV between all 125 grain bullets fired in all the 6" barrels was 376 fps, almost 8 times the EV in the test barrel. The EV for all 6" barreled revolvers with the 140 grain hollow point ammunition was 275 fps, over 10 times the EV in the test barrel. The 158 grain soft point ammunition showed an EV of 282 fps, almost seven times the test barrel EV of 38 fps.

These large variations are due partly to the relatively very small differences in chamber, bore, forcing cone rifling and barrel-cylinder gap dimensions and in the finish or smoothness of these interior surfaces. Chambers will vary minutely even though cut with the same reamer, as will all other machined surfaces. It is virtually impossible to manufacture two of some machined metal item, even as simple as a revolver, with all dimensions and finishes exactly the same. When hundreds of thousands of 357 Magnum revolvers have been made by thousands of different people, in different factories, with different materials and tooling, to different engineering tolerances, it cannot be surprising that there are differences between guns.

These minor differences between guns cause some of the differences in ballistic measurements. Additional variations, due to differences between different makes or lots of bullets, powder, primers and cases, powder charges, loading dies, loading techniques and chronographs complicate the problem. Many times these small differences tend to cancel each other, but when everything goes one way, the resulting variation may be relatively large.

These velocity tests are not presented with any idea of claiming that one particular brand or model of revolver is superior to another. A repeat of the test with different ammunition might well reverse the relative standings shown here. The point we want to make is that even with the very best quality ammunition available, there will always be velocity variations when the ammunition is fired in different guns.

357 Magnum Velocity Variation in Different Guns (fps)

Gun Description	Barrel Length	— Ammunition Used in Test — 125 Grain	140 Grain	158 Grain
S&W M19 #1	2.50"	1190	1132	1034
Colt Python	2.50"	1205	1118	989
S&W M19 #2	2.50"	1209	1118	1018
Ruger Security Six	2.75"	1233	1154	1075
Colt Trooper Mark III	4.00"	1317	1175	1101
S&W M66	4.00"	1385	1225	1117
S&W M19 #1	4.00"	1368	1227	1153
S&W M19 #2	4.00"	1374	1242	1146
Ruger Security Six #1	4.00"	1370	1242	1130
Ruger Security Six #2	4.00"	1380	1267	1151
Dan Wesson	4.00"	1358	1280	1160
Ruger Blackhawk #1	4.625"	1361	1266	1159
Ruger Blackhawk #2	4.625"	1480	1336	1196
Ruger Security Six #3	6.00"	1436	1311	1210
S&W M19 #1	6.00"	1400	1282	1179
S&W M19 #2	6.00"	1372	1281	1154
S&W M19 #3	6.00"	1603	1417	1284
S&W M28 #1	6.00"	1307	1246	1080
S&W M28 #2	6.00"	1499	1353	1178
S&W M27	6.00"	1547	1358	1248
Colt Python #1	6.00"	1227	1142	1002
Colt Python #2	6.00"	1477	1373	1251
Colt Python #3	6.00"	1468	1364	1207
Ruger Blackhawk (new)	6.50"	1471	1375	1262
S&W M27	8.375"	1501	1342	1221
Ruger Blackhawk	10.00"	1738	1544	1365
T/C Contender	10.00"	1944	1726	1587
Martini Rifle	17.375"	2121	1906	1678
Winchester 92 Rifle	20.00"	2153	1964	1824
Marlin 1894 Rifle	24.00"	2212	1994	1835
Velocity Test Barrel	10.00"	1866	1732	1591
Velocity Test Barrel Extreme Variation		48	26	38

CHAPTER 14

INTRODUCTION TO THE HANDGUN DATA

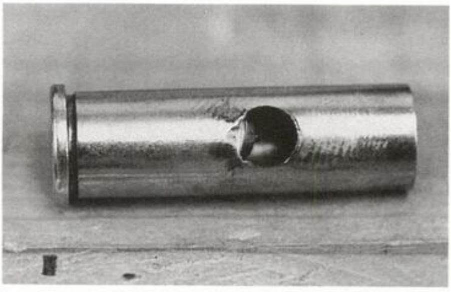
The following pages contain the data for reloading Speer bullets in handgun cartridges. The format follows that of the rifle data and includes the new same features.

One of these features, cartridge overall length or C.O.L., deserves mention again. Please understand that the lengths shown are those used in our testing. They are presented as a reference, and you must realize that your pistol or revolver may require you to load to a different length. Because most handgun cases are relatively small, changes in seating depth may cause drastic changes in pressure compared a much larger rifle case. If you find that your handgun requires a shorter length than our "as tested" length, you must reduce the powder charge.

Changes in Pressure Measurement Systems

Many of the handgun loads in this manual were developed using modern piezo-electric transducer equipment at CCI's Quality Assurance facility. In the past, all handgun loads were developed using copper crushers. There are some differences in crusher results compared to transducer resultss that you should understand.

Transducers are mounted to contact the side of the case, and are very sensitive to the events happening inside a cartridge through its entire firing cycle. Crusher gun systems measure at the case mouth for most handgun cartridges. By the time the pressure wave passes the case mouth, some short-lived events early in the firing cycle may be over. This difference in the two test methods shows up in load data.



A spent 357 Magnum case which was used in a crusher-type pressure barrel.

When relatively quick-burning propellants are used, the transducer picks up early pressure readings that contribute to the total pressure. The result is that charge weights of quick-burning propellants will usually be less in data developed on a transducer system than in data developed on a crusher system. When moderate to slow-burning powders are used, the differences between transducer and crusher tests are much smaller.

This effect has led us to show more powders having a moderate burning rate. Loads using Bullseye, 231 and similar powders may be less than shown in older Speer manuals. This doesn't mean the old loads are unsafe. They have been used for years with no problems. When we made the change to the high-tech transducer system, we wanted to make it across the board.

In the long run, this change allows us to give you better performance. We found that many of the newer propellants give handloaders the flexibility to improve on factory performance yet stay within industry pressure specifications. Another reason we prefer the powders with medium burning rates is that they give better accuracy with the new Gold Dot™ bullets.

The transducer system favors some cartridges more than others. We were able to improve on the performance of the 44 Special and 9mm Luger compared to past manuals. However, loads for the 357 Magnum are definitely down. The transducer limit is 35,000 psi; the current crusher limit for the same cartridge is 45,000 cup. This difference means many of the 357 Magnum loads are less than shown before, although the slow-burning propellants such as 296, H110 and VihtaVuori N110 gave very good velocities.

Using the Tables

There is a very simple rule for using the tables:

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Always start with the minimum load!

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All gun authorities recognize there are differences between individual firearms. The maximum loads shown were safe in the test equipment—both pressure barrels and production handguns—that we used during load development. However, your handgun may have some dimensional differences that could result in higher or lower operating pressures. Because you cannot know whether a pressure change will be up or down, using the starting load will give you the margin of safety required due to individual gun variations. Starting loads are generally 8 to 12 percent below maximum, depending on the size of the case.

Maximum loads mean exactly that—MAXIMUM! Under no circumstances should you exceed these loads. They are presented to indicate the maximum performance potential for the cartridge; however, variations in individual handguns may not permit safely using them in every situation.

Here is the bottom line— read it twice: YOU MUST ALWAYS START WITH THE MINIMUM LOAD AND CAREFULLY WORK UP TOWARD THE MAXIMUM IN SMALL STEPS, WATCHING FOR PRESSURE SIGNS AT EACH STEP.

Changing Components

ANY change in components— primers, bullets or cases— from those listed requires that you return to the starting load and work up, just as with a new load. We also recommend that you note the propellant lot you are using in your reloading records. If you change lots when assembling maximum loads, we suggest you drop the charge one to two grains and fire several test rounds to make sure the load still is safe for your handgun. Once this is established, you can carefully work up toward the old load level. Modern propellant manufacturing techniques give remarkable lot-to-lot consistency but some minor variations may still occur. Speer has no control over the manufacturing practices of other component companies. This is another reason why we develop and emphasize beginning with starting loads.

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NOTICE

THESE LOADS ARE FOR SPEER BULLETS. BULLETS OF OTHER MAKES WILL NOT PRODUCE THE SAME PRESSURES AND VELOCITIES.

ALL DATA CONTAINED HEREIN IS INTENDED FOR USE BY PERSONS FAMILIAR WITH HANDLOADING PRACTICES AND THEIR OWN LOADING EQUIPMENT. IF YOU ARE UNCERTAIN AS TO THE OPERATION OF YOUR EQUIPMENT, CONTACT THE EQUIPMENT MANUFACTURER FOR ADDITIONAL ASSISTANCE. NEW RELOADERS ARE STRONGLY URGED TO READ AND UNDERSTAND THE TEXT OF THIS MANUAL IN THE PRECEDING PAGES. IT HAS BEEN WRITTEN TO GIVE CLEAR INSTRUCTION IN THE PROCESSES USED IN RELOADING.

BECAUSE BLOUNT SPORTING EQUIPMENT DIVISION HAS NO CONTROL OVER INDIVIDUAL LOADING PRACTICES OR THE QUALITY OF THE FIREARMS IN WHICH THE RESULTING AMMUNITION MAY BE USED, NO RESPONSIBILITY—EITHER EXPRESSED OR IMPLIED—IS ASSUMED FOR THE USE OF THESE DATA.

THE DATA CONTAINED HEREIN REPLACES, SUPERCEDES AND OBSOLETES ALL DATA PREVIOUSLY PUBLISHED BY SPEER, OMARK INDUSTRIES AND BLOUNT, INC.

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22 HORNET (HANDGUN)

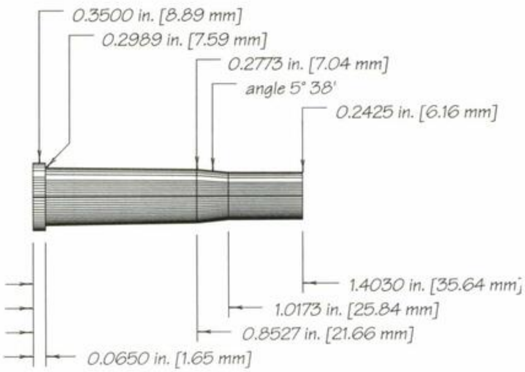
Although originally developed as a rifle cartridge, the compact 22 Hornet has also found favor as a handgun cartridge. Early attempts to convert revolvers were frustrating; however, in a good single-shot pistol the Hornet is a different story.

In the Thompson/Center Contender, the Hornet is as accurate as many rifles. Although the shorter pistol barrels give up velocity, the Hornet is still a very effective varmint cartridge out to 100 yards and, with the right wind conditions, maybe a bit further.

Best results in the Contender are gained by dedicating a batch of new cases to the T/C. After the first firing, only neck size these cases for subsequent reloadings. This will improve both case life and accuracy. The Hornet case is fairly thin, and may last for only three to four shots before showing incipient head separations. Inspect cases carefully after every firing.

The 40 and 45 grain bullets generally give the best performance in Hornet pistols. However, the 1-14 inch twist in the Contender will usually stabilize the Speer 50 grain TNT bullet. The TNT is one of the few heavy bullets which will expand at lower velocity levels; however, it must be carefully loaded to maximum levels to insure in-flight stability.

The recent change of the Hornet's industry maximum pressure from 47,000 to 43,000 cup has greatly reduced its velocity potential. However, it's still a flat-shooting little varmint combination when the shots aren't too long. Recoil is nearly non-existent but the muzzle blast is quite loud. This is a good reminder to always wear hearing protection when shooting any firearm.


0.3500 in. [8.89 mm]
0.2989 in. [7.59 mm]
0.2773 in. [7.04 mm]
angle 5° 38'
0.2425 in. [6.16 mm]
1.4030 in. [35.64 mm]
1.0173 in. [25.84 mm]
0.8527 in. [21.66 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.403"
Trim-to Length: 1.393"
Max. Cart. Length: 1.723"
RCBS Shellholder: #12
Barrel Length: 10"
Twist: 1-14"

Test Firearm: Thompson/Center Contender
Case: W-W
Primers: CCI 400

.223" Dia. **.224" Dia.** **40 Grain** Sect. Density .114	**22 Spire-SP**	**22 Spire-SP**				
Ballistic Coefficient	0.145	0.144				
C.O.L. Tested At	1.723"	1.723"				
Speer Part No.	1005	1017				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.5C**	**2261**	IMR 4198	**11.0C**	**2039**	AA 2015BR	**11.0C**	**1744**
	11.5	2056		10.0	1815		10.0	1593
H110	**8.5**	**2210**	296	**7.5**	**1977**			
	7.5	2035		6.5	1801			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.223" Dia. **45 Grain** Sect. Density .128	**22 Spitz-SP**	**22 Spitz-SP**				
Ballistic Coefficient	0.166	0.167				
C.O.L. Tested At	1.723"	1.723"				
Speer Part No.	1011	1023				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.5C**	**2155**	**IMR 4198**	**11.0C**	**2022**	**AA 2015BR**	**12.0C**	**1783**
	11.5	2081		10.0	1833		11.0	1632
Viht. N110	**8.5**	**2141**	**2400**	**6.5**	**1844**			
	7.5	1976		5.5	1641			

.223" Dia. **.224" Dia.** **50 Grain** Sect. Density .142	**22 Spitz-SP**	**22 TNT-HP**				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	1.723"	1.850" †				
Speer Part No.	1029	1030				

† exceeds SAAMI C.O.L.— for single shot pistols only.

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**12.0C**	**2117**	**296**	**7.4**	**1901**	**AA 2015BR**	**11.5C**	**1728**
	11.0	1957		6.4	1688		10.5	1570
Viht. N110	**8.0**	**2000**	**IMR 4198**	**10.5C**	**1893**			
	7.0	1791		9.5	1701			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

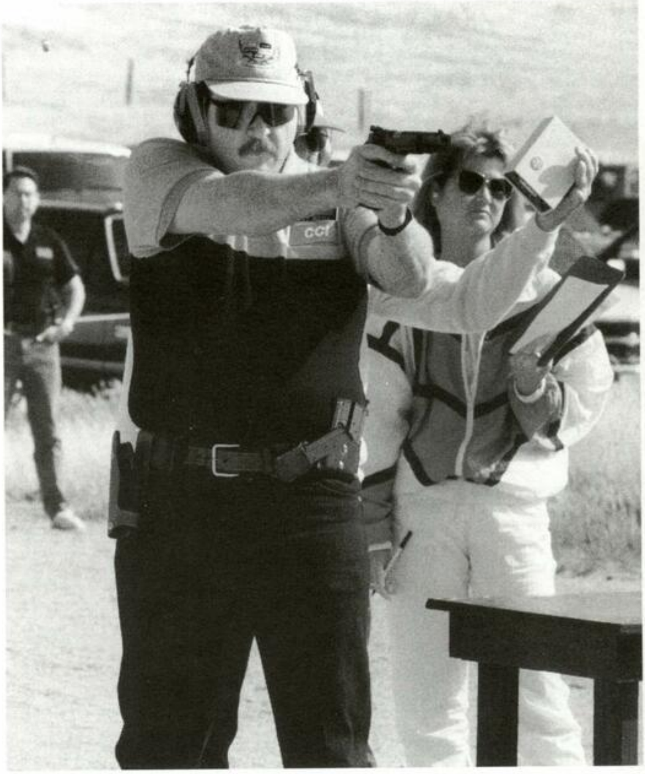
22 K-HORNET (HANDGUN)

The K-Hornet is a wildcat developed by Lysle Kilbourn prior to World War II. It was quite popular in rifles, but got a real boost when Thompson/Center offered the Contender single-shot pistol in this caliber.

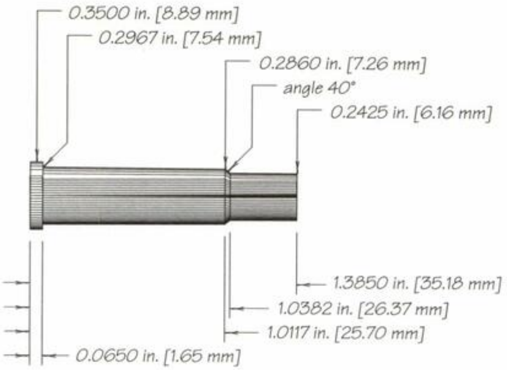
The K-Hornet is simply the standard Hornet case blown out to a nearly straight body, a shorter neck and a 35° shoulder angle. In pistols the velocity gain over the Hornet is modest, but still significant enough to justify case forming. The straight case requires full length sizing and case life is enhanced when the shoulder—not the rim—is used to control headspace. Cases are easily formed by firing standard 22 Hornet loads in the K-Hornet chamber. The straight case of the "K" version helps extend case life compared to the standard Hornet.

Like the standard Hornet, the K-Hornet is best with 40 and 45 grain bullets. Accuracy is excellent and the K-Hornet is a great 100 yard varmint cartridge in the Contender.

There are no pressure standards for the K-Hornet but the loads shown were safe in the test pistol.



Guy Neill, CCI/Speer Technical Service Administrator, competing in a handgun event.


0.3500 in. [8.89 mm]
0.2967 in. [7.54 mm]
0.2860 in. [7.26 mm]
angle 40°
0.2425 in. [6.16 mm]
1.3850 in. [35.18 mm]
1.0382 in. [26.37 mm]
1.0117 in. [25.70 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.385"
Trim-to Length: 1.375"
Max. Cart. Length: N/A
RCBS Shellholder: #12
Barrel Length: 10"
Twist: 1-14"

Test Firearm: Thompson/Center Contender
Case: W-W
Primers: CCI 400

.223" Dia. **.224" Dia.** **40 Grain** Sect. Density .114	**22 Spire-SP**	**22 Spire-SP**				
Ballistic Coefficient	0.144	0.145				
C.O.L. Tested At	1.723"	1.723"				
Speer Part No.	1005	1017				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4227	**11.7**	**2439**	2400	**9.6**	**2415**	IMR 4198	**11.7C**	**2119**
	11.0	2278		9.2	2299		11.0	1983

.223" Dia. **.224" Dia.** **45 Grain** Sect. Density .128	**22 Spitz-SP**	**22 Spitz-SP**				
Ballistic Coefficient	0.166	0.165				
C.O.L. Tested At	1.723"	1.723"				
Speer Part No.	1011	1023				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4227	**11.5**	**2370**	2400	**8.8**	**2257**	IMR 4198	**11.7C**	**2132**
	11.0	2251		8.4	2156		11.0	1995

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

221 REMINGTON FIREBALL

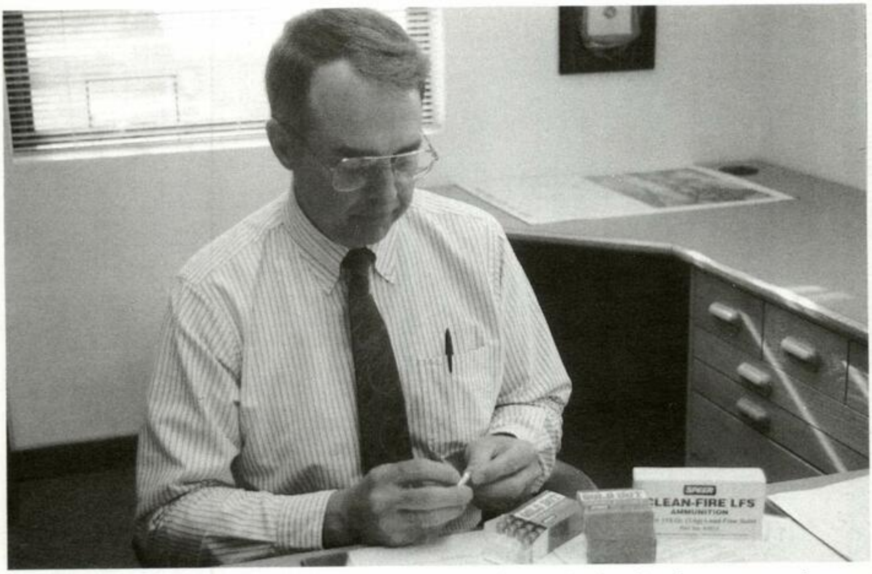
In 1962, Remington introduced the innovative XP-100 single-shot, bolt-action pistol. The 221 Fireball cartridge (basically a shortened 222 Remington) was specifically designed for the new pistol. The combination has proved to be very accurate and has accounted for a lot of varmints over the last thirty years.

An XP-100 or a T/C Contender with a good handgun scope is capable of shooting 100 yards groups under one inch. This kind of accuracy means the effective varmint hunting range is often over 200 yards depending on wind conditions. Although the size and shape of the XP-100 pistol doesn't lend itself to one-handed firing, the pistol is quite easy to support over a convenient rest.

Factory ammo chronographed at 2620 feet/sec from the 10-3/4 inch barrel. A 10 inch Contender posted nearly identical velocities. Most of the handloads shown will give velocities equal to factory loads. Factory brass is still available but cases can also be reformed from 222 or 223 Remington brass. If you are using reformed cases, necks must be reamed and loads reduced to accommodate the reduced case capacity.

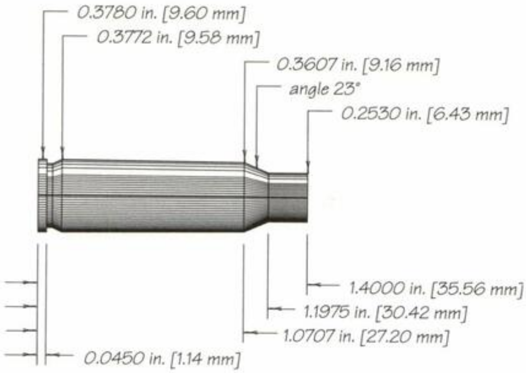
Remington no longer catalogs the 221 Fireball for the XP-100, having replaced it with the 223 Remington. Still, the little Fireball lives up to its name, coming within 300 feet/sec of the velocities of the 223 Remington pistol.

The industry maximum pressure for the 221 Fireball is 52,000 cup. The loads shown here fall within these guidelines.



Darrel Inman, CCI/Speer Vice-President of Engineering & New Product Developement examines some Speer high-performance centerfire ammunition.

221 REMINGTON FIREBALL



0.3780 in. [9.60 mm]
0.3772 in. [9.58 mm]
0.3607 in. [9.16 mm]
angle 23°
0.2530 in. [6.43 mm]
1.4000 in. [35.56 mm]
1.1975 in. [30.42 mm]
1.0707 in. [27.20 mm]
0.0450 in. [1.14 mm]

Max. Case Length: 1.400"
Trim-to Length: 1.390"
Max. Cart. Length: 1.830"
RCBS Shellholder: #10
Barrel Length: 10.75"
Twist: 1-12"

Test Firearm: Remington XP-100
Case: R-P
Primers: CCI 400, 450

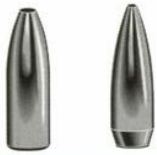
.224" Dia. **45 Grain** Sect. Density .128	22 Spitz-SP					
Ballistic Coefficient	0.167					
C.O.L. Tested At	1.830"					
Speer Part No.	1023					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2400	**15.0**	**2782**	**H110***	**14.0**	**2757**	**IMR 4227**	**16.2**	**2727**
	14.0	2599		13.0	2555		15.2	2571
Re7	**18.3**	**2775**	**IMR 4198**	**17.8C**	**2731**			
	17.3	2603		16.8	2556			

.224" Dia. **50 Grain** Sect. Density .142	22 Spitz-SP	22 TNT-HP				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	1.830"	1.830"				
Speer Part No.	1029	1030				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2400	**14.5**	**2693**	**Re7**	**17.9**	**2638**	**H110***	**13.5**	**2625**
	13.5	2521		16.9	2497		12.5	2429
IMR 4198	**17.5C**	**2664**	**IMR 4227**	**15.9**	**2634**			
	16.5	2503		14.9	2490			

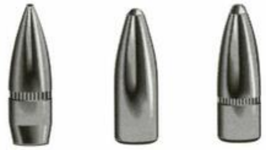
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.224" Dia.
52 Grain
Sect. Density .145

	22 HP	22 BT HP-Match				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	1.830"	1.830"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2400	**14.3**	**2607**	**IMR 4227**	**15.7**	**2585**	**H110***	**13.2**	**2465**
	13.3	2411		14.7	2404		12.2	2268
Re7	**17.7**	**2606**	**IMR 4198**	**17.0**	**2527**			
	16.7	2441		16.0	2330			



.224" Dia.
55 Grain
Sect. Density .157

	22 BT FMJ	22 Spitz-SP	22 Spitz-SP			
Ballistic Coefficient	0.269	0.255	0.241			
C.O.L. Tested At	1.830"	1.830"	1.830"			
Speer Part No.	1044	1047	1049			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4227	**15.4**	**2562**	**Re7**	**17.4**	**2501**	**H110***	**13.0**	**2432**
	14.5	2419		16.4	2348		12.0	2250
IMR 4198	**16.7**	**2502**	**2400**	**13.6**	**2477**			
	15.5	2317		12.5	2267			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

223 REMINGTON (HANDGUN)

The popularity of the 223 in rifles also made it a natural as a handgun cartridge. The most popular handguns are the Remington XP-100 bolt action and the Thompson/Center Contender single-shot pistols. Velocities in 14 inch barrels are surprisingly high—often within 90 percent of rifle velocities—and both pistols are capable of excellent accuracy.

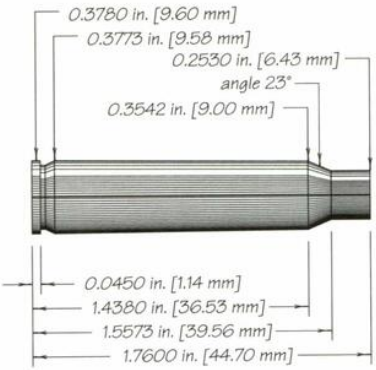
Reloading the 223 pistol is straight-forward. Even the slower burning propellants gave good performance and velocities with all loads were quite uniform. Sizing cases is done the same way as with any bottlenecked rifle cartridge. As long as you are shooting cases in only one 223 pistol, neck sizing is strongly recommended. Be sure to use small rifle primers as recommended.

Several of the propellants tested gave a dazzling muzzle flash. This is often unavoidable when shooting rifle cartridges in handguns.

There is some variation in the internal construction of 223 cases. As a result, we strongly recommend that you begin with the starting loads and work up carefully toward the maximum levels. The IMI cases used to developed these loads have the same capacity as most military cases; therefore, these loads can be safely used in surplus military brass.

Bullets heavier than 55 grains do not stabilize well in most 223 pistols, so we do not recommend them. The 50 grain TNT hollow point is ideal for 223 pistols. Its fine accuracy and explosive terminal effects combine to make it an excellent varmint bullet.

These loads are within the industry maximum of 52,000 cup.


0.3780 in. [9.60 mm]
0.3773 in. [9.58 mm]
0.2530 in. [6.43 mm]
angle 23°
0.3542 in. [9.00 mm]
0.0450 in. [1.14 mm]
1.4380 in. [36.53 mm]
1.5573 in. [39.56 mm]
1.7600 in. [44.70 mm]

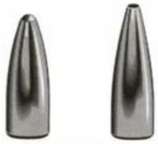
Max. Case Length: 1.760"
Trim-to Length: 1.750"
Max. Cart. Length: 2.260"
RCBS Shellholder: #10
Barrel Length: 14"
Twist: 1-12"

Test Firearm: Thompson/Center Contender
Case: IMI
Primers: CCI 400, 450

.224" Dia. **45 Grain** Sect. Density .128	**22** **Spitz-SP**					
Ballistic Coefficient	0.167					
C.O.L. Tested At	2.155"					
Speer Part No.	1023					

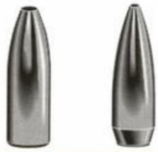
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 3031	**27.0C**	**3121**	IMR 4198	**23.0**	**3061**	AA 2015BR	**25.0**	**3010**
	25.0	2712		21.0	2782		23.0	2760
748*	**28.5C**	**3097**	H322	**26.0**	**3029**	AA 2460*	**26.0**	**2967**
	26.5	2858		24.0	2713		24.0	2683
Viht. N133	**24.5**	**3065**	IMR 4895	**27.0C**	**3022**	Re7	**20.0**	**2636**
	22.5	2789		25.0	2701		18.0	2564

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.224" Dia. **50 Grain** Sect. Density .142	22 Spitz-SP	22 TNT-HP				
Ballistic Coefficient	0.231	0.223				
C.O.L. Tested At	2.185"	2.250"				
Speer Part No.	1029	1030				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**26.0**	**3068**	**IMR 3031**	**26.0C**	**2960**	**Viht. N133**	**24.0**	**2900**
	24.0	2749		24.0	2571		22.0	2638
IMR 4895	**27.0C**	**3037**	**748***	**28.0**	**2954**	**AA 2015BR**	**24.5**	**2890**
	25.0	2714		26.0	2728		22.5	2651
AA 2520*	**28.0C**	**3030**	**H4895**	**25.5C**	**2917**	**IMR 4198**	**22.0**	**2870**
	26.0	2848		23.5	2537		20.0	2608



.224" Dia. **52 Grain** Sect. Density .147	22 HP	22 BT HP-Match				
Ballistic Coefficient	0.225	0.253				
C.O.L. Tested At	2.200"	2.250"				
Speer Part No.	1035	1036				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**28.0**	**3083**	**IMR 4198**	**22.0**	**2858**	**H322**	**24.5**	**2846**
	26.0	2846		20.0	2598		22.5	2550
Viht. N133	**24.0**	**2950**	**H4895**	**25.5C**	**2989**	**IMR 3031**	**26.0C**	**3027**
	22.0	2684		23.5	2600		24.0	2630
AA 2015BR	**24.0**	**2903**	**IMR 4895**	**26.5C**	**2998**	**AA 2520***	**27.5C**	**3077**
	22.0	2662		24.5	2680		25.5	2892

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.224" Dia. **55 Grain** Sect. Density .157	**22 BT FMJ**	**22 Spitz-SP**	**22 Spitz-SP**			
Ballistic Coefficient	0.269	0.255	0.241			
C.O.L. Tested At	2.175"	2.175"	2.175"			
Speer Part No.	1044	1047	1049			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2520*	**27.0C**	**3008**	**IMR 3031**	**26.0C**	**2962**	**H322**	**24.5**	**2792**
	25.0	2827		24.0	2574		22.5	2501
H4895	**25.5C**	**2983**	**IMR 4895**	**26.5C**	**2932**	**AA 2015BR**	**23.5**	**2765**
	23.5	2595		24.5	2621		21.5	2535
748*	**28.0C**	**2964**	**Viht. N133**	**23.5**	**2849**	**IMR 4198**	**21.0**	**2721**
	26.0	2735		21.5	2593		19.0	2473

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT SAFETY FIRST RIGHT

6mm T/CU

Noted cartridge developer and gunsmith Wes Ugalde designed a family of wildcat cartridges with the T/CU name, for Thompson/Center Ugalde. They are based on the 223 Remington case necked up to handle larger bullets. The shoulder angle is also increased to 40° and the body taper decreased to maximize powder capacity.

The T/CU family was developed for silhouette competition but the lack of heavy 6mm bullets makes it less successful at knocking over steel targets than its big brother, the 7mm T/CU. The 6mm version turns out to be an excellent small game and varmint cartridge with the hitting power and accuracy for 200 yards shots. The 6mm T/CU is marginal for deer, requiring near-perfect shot placement and reasonably short ranges.

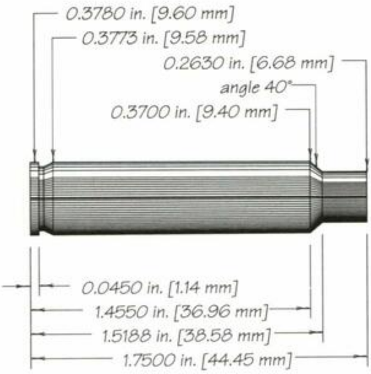
Cases are made by necking up 223 Remington cases using the tapered expander ball furnished with most dies sets for this cartridge. Fireforming completes the process. We recommend using commercial—not military—brass. Military brass is harder to fireform and has less powder capacity. Resizing fired cases requires care. The shoulder must not be pushed back during resizing to avoid misfires and poor accuracy. Don't expect more than three or four maximum load firings before the cases need to be retired. Using lighter loads will extend case life and we found that they gave better accuracy.

As with other wildcat and proprietary cartridges, no pressure standards exist for the T/CU cartridges. However, these loads were safe in our test pistol.

CAUTION
Range in use
CAUTION

Joan Ireland, CCI/Speer Ballistic Technician, firing rifle cartridges for data collection.

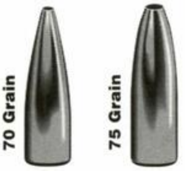
6mm T/CU



0.3780 in. [9.60 mm]
0.3773 in. [9.58 mm]
0.2630 in. [6.68 mm]
angle 40°
0.3700 in. [9.40 mm]
0.0450 in. [1.14 mm]
1.4550 in. [36.96 mm]
1.5188 in. [38.58 mm]
1.7500 in. [44.45 mm]

Max. Case Length: 1.750"
Trim-to Length: 1.740"
Max. Cart. Length: N/A
RCBS Shellholder: #10
Barrel Length: 14"
Twist: 1-10"

Test Firearm: Thompson/Center Contender
Case: R-P (reformed)
Primers: CCI 400, 450

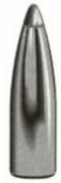


70 Grain
75 Grain

.243" Dia. 70 Grain 75 Grain	**6mm TNT-HP**	**6mm HP**				
Sectional Density	0.169	0.181				
Ballistic Coefficient	0.282	0.234				
C.O.L. Tested At	2.510"	2.480"				
Speer Part No.	1206	1205				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**31.0C**	**2966**	**AA 2230**	**30.0C**	**2865**	**Re7**	**26.0**	**2739**
	29.0	2765		28.0	2622		24.0	2515
IMR 4198	**26.0C**	**2934**	**IMR 4320**	**30.0C**	**2786**	**IMR 4895**	**30.0C**	**2719**
	24.0	2806		28.0	2593		28.0	2503
BL-C(2)*	**30.0**	**2929**	**748***	**31.0C**	**2751**	**IMR 4064**	**29.0C**	**2662**
	28.0	2443		29.0	2554		27.0	2444

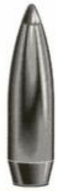
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia.
80 Grain
Sect. Density .193

	6mm Spitz-SP					
Ballistic Coefficient	0.365					
C.O.L. Tested At	2.510"					
Speer Part No.	1211					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**30.0C**	**2874**	**AA 2230**	**29.0**	**2716**	**IMR 4064**	**29.0C**	**2645**
	28.0	2654		27.0	2524		27.0	2440
IMR 4198	**25.0C**	**2767**	**IMR 4895**	**29.5C**	**2670**	**Re7**	**25.5**	**2646**
	23.0	2552		27.5	2502		23.5	2578
748*	**31.0C**	**2742**	**IMR 4320**	**29.0C**	**2646**	**BL-C(2)***	**29.0**	**2586**
	29.0	2590		27.0	2481		27.0	2501

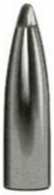


.243" Dia.
85 Grain
Sect. Density .206

	6mm BT Spitz-SP					
Ballistic Coefficient	0.404					
C.O.L. Tested At	2.500"					
Speer Part No.	1213					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**29.0**	**2735**	**AA 2230**	**28.5**	**2678**	**IMR 4320**	**28.0C**	**2596**
	27.0	2554		26.5	2504		26.0	2407
748*	**31.0C**	**2695**	**IMR 4198**	**24.0C**	**2665**	**IMR 4064**	**27.0C**	**2485**
	29.0	2508		22.0	2460		25.0	2247
IMR 4895	**29.5C**	**2694**	**Re7**	**25.0**	**2639**	**BL-C(2)***	**28.0**	**2432**
	27.5	2500		23.0	2431		26.0	2212

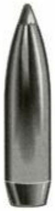
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.



.243" Dia.
90 Grain
Sect. Density .217

	6mm Spitz-SP					
Ballistic Coefficient	0.385					
C.O.L. Tested At	2.580"					
Speer Part No.	1217					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**30.0C**	**2636**	**AA 2230**	**28.0**	**2583**	**IMR 4320**	**27.0**	**2456**
	28.0	2453		26.0	2405		25.0	2291
IMR 4895	**29.0C**	**2612**	**Re7**	**24.5**	**2492**	**IMR 4064**	**27.0C**	**2438**
	27.0	2420		22.5	2436		25.0	2247
H335	**28.0**	**2608**	**IMR 4198**	**23.0**	**2488**	**BL-C(2)***	**27.5**	**2360**
	26.0	2466		21.0	2292		25.5	2131



.243" Dia.
100 Grain
Sect. Density .242

	6mm BT Spitz-SP					
Ballistic Coefficient	0.430					
C.O.L. Tested At	2.560"					
Speer Part No.	1220					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**29.0**	**2586**	**IMR 4895**	**27.5**	**2422**	**IMR 4320**	**26.0**	**2348**
	27.0	2368		25.5	2235		24.0	2143
AA 2230	**27.0**	**2510**	**Re7**	**23.5**	**2378**	**IMR 4198**	**22.0**	**2347**
	25.0	2284		21.5	2273		20.0	2173
H335	**26.5**	**2499**	**IMR 4064**	**26.0**	**2370**	**BL-C(2)***	**26.5**	**2336**
	24.5	2297		24.0	2111		24.5	2181

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.243" Dia. **100 Grain** Sect. Density .254	**6mm** **RN-SP**					
Ballistic Coefficient	0.207					
C.O.L. Tested At	2.630"					
Speer Part No.	1223					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**28.0**	**2442**	**IMR 4895**	**26.5**	**2341**	**IMR 4064**	**25.0**	**2235**
	26.0	2252		24.5	2139		23.0	2054
H335	**25.5**	**2368**	**Re7**	**22.5**	**2295**	**IMR 4198**	**21.0**	**2230**
	23.5	2186		20.5	2171		19.0	2061
AA 2230	**26.0**	**2365**	**IMR 4320**	**25.0**	**2257**	**BL-C(2)***	**25.5**	**2221**
	24.0	2180		23.0	2060		23.5	2047

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

6.5 JDJ

The JDJ in the name of this cartridge stands for J.D. Jones, founder and owner of SSK Industries. J.D. has developed a remarkable family of proprietary hunting cartridges for use in custom Thompson/Center Contenders. The entire series has proven their worth in hunting fields around the world.

J.D.'s Contender cartridges are based on two cases. The larger calibers are derived from the 444 Marlin case and the smaller ones from the 225 Winchester case. The 6.5 falls into the latter group.

The 225 case is a true rimmed cartridge (despite some early hype about its being semi-rimmed). This makes it a natural for the single-shot Contender. Another attribute of the 225 case is its heavy construction. These cases can contain full-pressure hunting loads to deliver excellent performance.

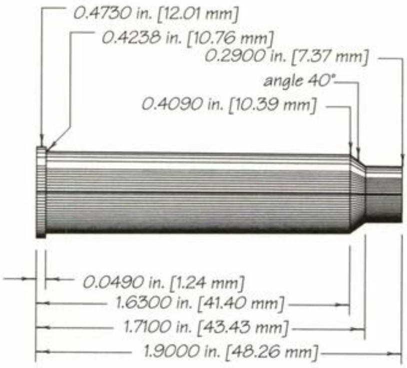
The 6.5 is easily formed by expanding the case neck using the tapered expander ball furnished with the die set and then fire-forming with a charge at about 90 percent of maximum. The 120 grain Speer bullet with 30.0 grains of IMR 4320 makes an excellent case-forming load. Loss during forming is practically zero and case life is excellent with normal reloading practices. The cartridge features a short neck, minimum body taper and a 40° shoulder, resulting in maximum case capacity.

Because most 6.5mm (.263") component bullets were designed for the 6.5x55mm Mauser cartridge, they give optimum performance at moderate velocities. The 6.5 JDJ falls into the lower end of this velocity range so its terminal performance on game is excellent. It gives proper penetration even with the lighter 120 grain bullets. Typical loads give close to 2400 feet/sec with Speer's 120 grain bullet and over 2200 feet/sec with our 140 grain spitzer.

A number of powders give excellent ballistics in the 6.5 JDJ which is a tribute to its efficient design. Even some of the slow-burning powders give surprising velocities. However, IMR 4320 seems to be the most popular propellant for this cartridge. Reloder 15, VihtaVuori N140 and Accurate Arms 2520 are also good choices

J.D. states that the 6.5 has taken game up to 400 pounds and that it is an effective deer cartridge out to 275 yards. We see no reason to dispute this claim. The cartridge shows phenomenal accuracy at long range. According to Jones, the 6.5 JDJ is second in popularity only to his big 375 JDJ cartridge.

Custom JDJ barrels and reloading dies are available directly from SSK Industries (721 Woodvue Lane, Wintersville OH 43952).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0.2900 in. [7.37 mm]
angle 40°
0.4090 in. [10.39 mm]
0.0490 in. [1.24 mm]
1.6300 in. [41.40 mm]
1.7100 in. [43.43 mm]
1.9000 in. [48.26 mm]

Max. Case Length: 1.900"
Trim-to Length: 1.890"
Max. Cart. Length: 2.700"
RCBS Shellholder: #11
Barrel Length: 14"
Twist: 1-9"

Test Firearm: SSK Custom Contender
Case: W-W
Primers: CCI 200

.263" Dia. **120 Grain** Sect. Density .248	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.433					
C.O.L. Tested At	2.700"					
Speer Part No.	1435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**35.0**	**2396**	**760**	**38.0**	**2365**	**IMR 4320**	**34.0**	**2333**
	31.0	2122		34.0	2116		30.0	2059
H4350	**39.0C**	**2386**	**H414**	**38.0**	**2351**	**Re19**	**40.0C**	**2272**
	35.0	2141		34.0	2104		36.0	2045
Viht. N140	**34.3**	**2376**	**IMR 4831**	**40.0C**	**2351**			
	30.3	2099		36.0	2116			
IMR 4350	**39.0C**	**2372**	**Re22**	**41.5C**	**2344**			
	35.0	2129		37.5	2118			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.263" Dia. **140 Grain** Sect. Density .114	**6.5mm Spitz-SP**					
Ballistic Coefficient	0.496					
C.O.L. Tested At	2.700"					
Speer Part No.	1441					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N160	**38.5C**	**2230**	**H414**	**35.5**	**2162**	**IMR 4320**	**32.0**	**2136**
	34.5	1998		31.5	1918		28.0	1927
Re15	**32.5**	**2204**	**AA 2520**	**30.5**	**2155**	**760**	**35.0**	**2133**
	28.5	1938		26.5	1873		31.0	1880
IMR 4064	**31.5**	**2169**	**H380**	**35.0**	**2145**	**Re19**	**37.5C**	**2095**
	27.5	1894		31.0	1900		33.5	1872
Viht. N140	**32.0**	**2168**	**IMR 4350**	**36.0C**	**2140**	**H4831**	**38.0C**	**2050**
	28.0	1897		32.0	1928		34.0	1834

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

John Taffin, Gun Writer, took this Black Buck at 200 yards with his 6.5 JDJ. (120 gr. Hot-Cor)

7mm REMINGTON BR

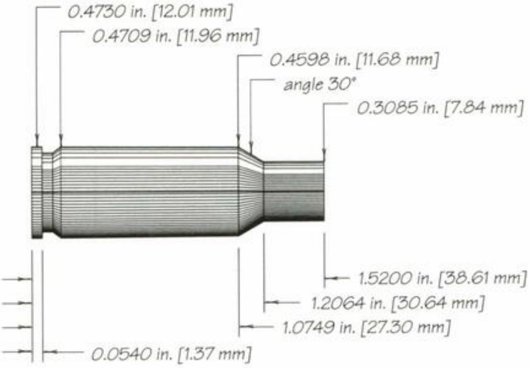
The 7mm Remington BR started life as a wildcat cartridge based on another wildcat, the 308x1.5", which is a shortened 308 Winchester. The short, 30 caliber case is necked down to hold .284" bullets and given a 30° shoulder angle and minimum body taper. A number of experimenters have worked with similar wildcat cartridges, but Remington standardized this one.

An XP-100 Silhouette pistol was introduced in 1980 chambered for the 7mm BR wildcat. Remington furnished a special 308 match case with a small primer pocket. Because forming BR cases proved to be a chore, the popularity of the cartridge suffered until 1986 when Remington began selling fully-formed 7mm BR cases and loaded ammunition

This is a very accurate cartridge that is popular with long-range target shooters in silhouette competition where steel targets are shot with handguns out to 200 meters. Most 7mm bullets fired in the 7mm BR have sufficient power to topple steel targets if the shooter scores a solid hit.

For hunting, the 7mm BR is suitable for varmints and the smaller deer species. We have listed loads using bullets up to 175 grains but most hunters will find the the 130 to 145 grain bullets provide a good combination of effective terminal performance without the trajectory becoming too arched. The Speer 110 grain TNT or the 115 grain hollow point are ideal for varmints.

The data listed was fired from a 10 inch barrel. Current XP-100 pistols for this cartridge feature 14-1/2 in barrels. The industry maximum pressure for the 7mm BR is 52,000 cup.


0.4730 in. [12.01 mm]
0.4709 in. [11.96 mm]
0.4598 in. [11.68 mm]
angle 30°
0.3085 in. [7.84 mm]
1.5200 in. [38.61 mm]
1.2064 in. [30.64 mm]
1.0749 in. [27.30 mm]
0.0540 in. [1.37 mm]

Max. Case Length: 1.520"
Trim-to Length: 1.510"
Max. Cart. Length: N/A
RCBS Shellholder: #3
Barrel Length: 10"
Twist: 1-14"

Test Firearm: Remington XP-100
Case: R-P
Primers: CCI 400, 450

Note: Velocities fired using 115 gr. bullet

.284" Dia. 110 Grain 115 Grain	**7mm TNT-HP**	**7mm HP**				
Sectional Density	0.195	0.209				
Ballistic Coefficient	0.338	0.257				
C.O.L. Tested At	2.225"	2.235"				
Speer Part No.	1616	1617				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)	**34.5C**	**2682**	**748***	**34.5C**	**2416**	**IMR 4064**	**32.5C**	**2387**
	32.5	2521		32.5	2294		30.5	2210
H335	**32.5**	**2518**	**Re7**	**26.4**	**2411**	**H322**	**29.7C**	**2379**
	30.5	2346		24.4	2234		27.7	2235
IMR 4320	**33.0C**	**2456**	**IMR 4895**	**33.0C**	**2407**	**IMR 3031**	**31.0C**	**2363**
	31.0	2315		31.0	2212		29.0	2254

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

120 Grain
130 Grain
130 Grain

Note: Velocities fired using 130 gr. bullet

.284" Dia. **120 Grain** **130 Grain**	**7mm Spitz-SP**	**7mm Spitz-SP**	**7mm BT Spitz-SP**			
Sectional Density	0.213	0.230	0.230			
Ballistic Coefficient	0.386	0.394	0.411			
C.O.L. Tested At	2.235"	2.235"	2.235"			
Speer Part No.	1620	1623	1624			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4895	**31.0C**	**2299**	**H335**	**30.5**	**2289**	**BL-C(2)**	**32.0C**	**2212**
	29.0	2167		28.5	2116		30.0	2075
748*	**33.0**	**2295**	**H322**	**28.0C**	**2261**	**IMR 4064**	**32.0C**	**2123**
	31.0	2159		26.0	2059		30.0	1971
IMR 4320	**32.0**	**2295**	**IMR 3031**	**29.0C**	**2242**	**Re7**	**25.0**	**2074**
	30.0	2125		28.0	2079		23.0	1901

.284" Dia. **145 Grain** Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**			
Ballistic Coefficient	0.502	0.430	0.465			
C.O.L. Tested At	2.225"	2.225"	2.225"			
Speer Part No.	1628	1629	1631			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**31.5**	**2373**	**H335**	**29.0**	**2248**	**Re7**	**24.5**	**2193**
	29.5	2187		27.0	2096		22.5	1997
IMR 4320	**31.0C**	**2333**	**748***	**32.0C**	**2228**	**IMR 4895**	**29.0C**	**2179**
	29.0	2232		30.0	2075		27.0	2024
BL-C(2)	**30.0**	**2324**	**H322**	**27.5**	**2218**	**IMR 3031**	**27.5**	**2142**
	28.0	2166		25.5	2069		25.5	1982

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.284" Dia. 160 Grain Sect. Density .284	7mm BT Spitz-SP	7mm Spitz-SP	7mm MT-SP			
Ballistic Coefficient	0.556	0.502	0.354			
C.O.L. Tested At	2.235"	2.235"	2.225"			
Speer Part No.	1634	1635	1637			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**29.5C**	**2209**	**748***	**31.0C**	**2116**	**IMR 4895**	**27.0C**	**2014**
	27.5	2023		29.0	1983		25.0	1881
IMR 4320	**29.0C**	**2126**	**H335**	**28.0**	**2123**	**Re7**	**23.0**	**2011**
	27.0	1977		26.0	1957		21.0	1830
BL-C(2)	**28.0**	**2116**	**H322**	**26.5**	**2072**	**IMR 3031**	**26.0C**	**1996**
	26.0	1971		24.5	1922		24.0	1847

.284" Dia. 175 Grain Sect. Density .310	7mm MT-SP					
Ballistic Coefficient	0.385					
C.O.L. Tested At	2.220"					
Speer Part No.	1641					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**27.0**	**2046**	**H322**	**26.0**	**1998**	**IMR 4895**	**25.0**	**1841**
	25.0	1864		24.0	1837		23.0	1672
748*	**30.0**	**2028**	**BL-C(2)**	**26.0**	**1949**	**Re7**	**21.0**	**1810**
	28.0	1898		24.0	1776		19.0	1661
IMR 4064	**27.5**	**2016**	**IMR 3031**	**25.0**	**1903**	**IMR 4320**	**27.0**	**1693**
	25.5	1881		23.0	1756		25.0	1559

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

7mm T/CU

The 7mm T/CU is the most popular of Wes Ugalde's series of silhouette competition cartridges for the Thompson/Center Contender. Like other cartridges in the series, it is based on the 223 Remington case necked up and blown out.

Cases are made by expanding the 223's neck with a tapered expander ball and fire-forming using a charge at about 90 percent of the recommended maximum. We strongly recommend sorting cases by brand before forming and firing.

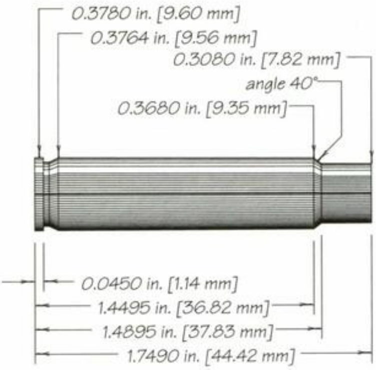
Reloading these cases requires care and attention. The small, narrow shoulder is easily bulged or collapsed. We suggest that you neck size only and thoroughly clean inside the case necks before sizing. The case mouth must be properly chamfered before seating bullets to prevent case damage. When setting the sizer die, make certain that the case shoulder doesn't touch the shoulder in the die. The tiny shoulder is easily displaced, and doing so causes excessive headspace. Case life and accuracy will both suffer and misfires may occur.

The extra attention required to reload the 7 T/CU is more than compensated by the shooting qualities of this fine cartridge. It is quite accurate with the full range of 7mm bullets and has sufficient power for the smaller deer species. On silhouette ranges, the 7mm T/CU has helped earn many awards for IHMSA competitors.

Best results are obtained by using commercial cases. Military cases are heavier and don't fire-form as well.

EAR PROTEC
QUIRED

LaVern Chapman, Centerfire QA Technician, accuracy testing pistol ammo.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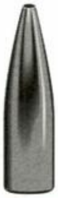
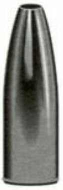
0.3764 in. [9.56 mm]
0.3080 in. [7.82 mm]
angle 40°
0.3680 in. [9.35 mm]
0.0450 in. [1.14 mm]
1.4495 in. [36.82 mm]
1.4895 in. [37.83 mm]
1.7490 in. [44.42 mm]

Max. Case Length: 1.749"
Trim-to Length: 1.739"
Max. Cart. Length: N/A
RCBS Shellholder: #10
Barrel Length: 14"
Twist: 1-9"

Test Firearm: Thompson/Center Contender
Case: Federal
Primers: CCI 400


110 Grain

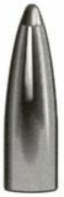

115 Grain

Note: Velocities fired using 115 gr. bullet

.284" Dia. 110 Grain 115 Grain	**7mm TNT-HP**	**7mm HP**				
Sectional Density	0.195	0.209				
Ballistic Coefficient	0.338	0.257				
C.O.L. Tested At	2.410"	2.410"				
Speer Part No.	1616	1617				

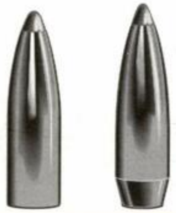
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**29.0**	**2346**	AA 2230	**29.5**	**2255**	IMR 4198	**23.5**	**2178**
	27.0	2184		27.5	2102		21.5	1993
AA 2015BR	**28.5**	**2339**	H335	**32.5**	**2254**	IMR 3031	**28.2C**	**2149**
	26.5	2175		30.5	2115		26.2	1997
Viht. N130	**26.5**	**2307**	AA 2460	**30.0**	**2253**	H4895	**29.3C**	**2127**
	24.5	2133		28.0	2103		27.3	1982
IMR 4895	**30.3C**	**2281**	Viht. N133	**27.5**	**2249**	H4198	**23.5**	**2107**
	28.3	2130		25.5	2085		21.5	1928
BL-C(2)	**33.0**	**2277**	Re12	**31.0C**	**2226**	Re7	**23.5**	**2062**
	31.0	2139		29.0	2083		21.5	1887

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.284" Dia. **120 Grain** Sect. Density .114	**7mm Spitz-SP**					
Ballistic Coefficient	0.386					
C.O.L. Tested At	2.410"					
Speer Part No.	1620					

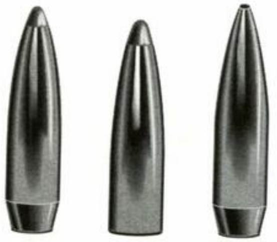
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
2015BR	**28.5**	**2281**	**AA 2520**	**30.0**	**2209**	**Viht. N135**	**27.0C**	**2171**
	26.5	2121		28.0	2062		25.0	2010
H335	**31.5**	**2237**	**AA 2230**	**29.5**	**2201**	**H4895**	**29.0C**	**2160**
	29.5	2095		27.5	2052		27.0	2011
Re12	**31.0C**	**2229**	**H322**	**27.5**	**2194**	**IMR 3031**	**28.0C**	**2146**
	29.0	2085		25.5	2034		26.0	1993
BL-C(2)	**32.0**	**2217**	**IMR 4895**	**29.0C**	**2178**	**Re7**	**24.0**	**2126**
	30.0	2078		27.0	2028		22.0	1949
Viht. N133	**25.9**	**2213**	**IMR 4198**	**24.0**	**2172**	**H4198**	**23.5**	**2120**
	23.9	2042		22.0	1991		21.5	1940



.284" Dia. **130 Grain** Sect. Density .230	**7mm Spitz-SP**	**7mm BT Spitz-SP**				
Ballistic Coefficient	0.394	0.414				
C.O.L. Tested At	2.465"	2.465"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 2015BR	**28.0**	**2279**	**Re12**	**29.5C**	**2172**	**H4895**	**28.5**	**2117**
	26.0	2116		27.5	2025		26.5	1968
AA 2230	**29.0**	**2210**	**Viht. N130**	**25.0**	**2157**	**BL-C(2)**	**30.0**	**2109**
	27.0	2058		23.0	1984		28.0	1968
IMR 4895	**29.2C**	**2201**	**H335**	**29.4**	**2145**	**IMR 4198**	**23.0**	**2100**
	27.2	2030		27.4	1999		21.0	1917
AA 2460	**29.0**	**2193**	**748**	**31.0**	**2130**	**Re7**	**23.0**	**2061**
	27.0	2042		29.0	1993		21.0	1882
H322	**27.0**	**2192**	**IMR 3031**	**28.0**	**2120**	**H4198**	**23.0**	**2052**
	25.0	2030		26.0	1969		21.0	1874

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.284" Dia. **145 Grain** Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**			
Ballistic Coefficient	0.502	0.430	0.465			
C.O.L. Tested At	2.475"	2.475"	2.500"			
Speer Part No.	1628	1629	1631			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**27.0**	**2118**	**AA 2460**	**28.0**	**2045**	**IMR 3031**	**27.2C**	**2016**
	25.0	1961		26.0	1899		25.2	1868
AA 2520	**29.0**	**2116**	**AA 2230**	**26.5**	**2040**	**Re12**	**28.5C**	**2008**
	27.0	1970		24.5	1886		26.52	1867
AA 2015BR	**25.5**	**2105**	**BL-C(2)**	**29.5C**	**2039**	**748**	**30.0C**	**1989**
	23.5	1940		27.5	1901		28.0	1856
IMR 4895	**28.5**	**2099**	**Viht. N130**	**24.0**	**2024**	**Viht. N133**	**24.5**	**1974**
	26.5	1952		22.0	1855		22.5	1813
H4895	**28.0**	**2090**	**H335**	**28.0**	**2018**	**Re7**	**22.0**	**1872**
	26.0	1941		26.0	1874		20.0	1702

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

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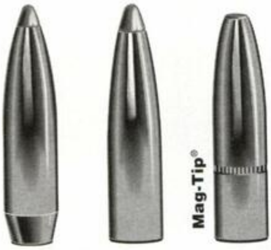


.284" Dia.
160 Grain

Sect. Density .284

	7mm BT Spitz-SP	7mm Spitz-SP	7mm MT-SP			
Ballistic Coefficient	0.556	0.502	0.354			
C.O.L. Tested At	2.670"	2.670"	2.670"			
Speer Part No.	1634	1635	1637			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322	**26.5**	**1988**	**748**	**29.0**	**1899**	**AA 2230**	**25.5**	**1839**
	24.5	1838		27.0	1768		23.5	1695
IMR 4895	**27.5**	**1971**	**H335**	**28.0**	**1889**	**Viht. N130**	**22.0**	**1776**
	25.5	1828		26.0	1754		20.0	1615
H4895	**27.5C**	**1938**	**AA 2520**	**26.5**	**1883**	**Viht. N135**	**24.9**	**1772**
	25.5	1797		24.5	1741		22.9	1630
AA 2460	**27.5**	**1932**	**BL-C(2)**	**28.0**	**1879**	**Re7**	**20.5**	**1721**
	25.5	1792		26.0	1745		18.5	1553
IMR 3031	**26.5**	**1914**	**AA 2015BR**	**24.5**	**1878**	**Viht. N120**	**19.3**	**1716**
	24.5	1770		22.5	1725		17.3	1538

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

7mm INTERNATIONAL RIMMED (7-R)

If any single individual is responsible for popularizing handgun silhouette shooting, then it is the late Elgin Gates. He founded the International Handgun Metallic Silhouette Association—IHMSA—as the governing body for the sport and provided much of the technical knowledge.

Since then, metallic silhouette handgun shooting has attracted a lot of new shooters to handgun competition and spawned an incredible number of interesting wildcat cartridges to boot. Many of these were the work of Mr. Gates.

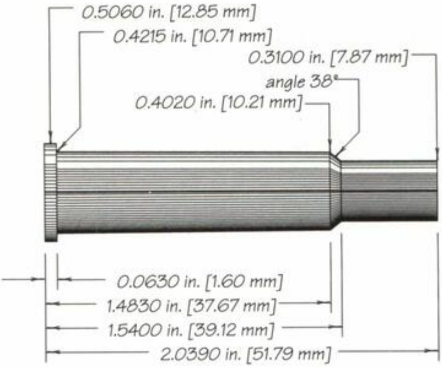
The 7mm International Rimmed, or 7-R for short, is one of Gates' cartridges. Originally, 7-R cases were formed from 30-30 brass by necking down and fire-forming. Because 30-30 brass is somewhat thin, cases tended to stretch excessively. Gates then switched to 375 Winchester cases, which are heavier and make better, longer-lasting cases.

The loads shown here are safe for use in reformed 30-30 brass, but you need to watch for signs of stretching. When using cases made from 375 Winchester brass, reduce charges one to two grains and work up as pressure indications dictate.

In addition to its usefulness for IHMSA competition, the 7-R is a fine small game and whitetail deer cartridge. The long neck makes it an easier cartridge to reload than the 7mm T/CU.

As with most custom guns and wildcat cartridges, there are small variations among chambers. Because of this, it is important to begin with the starting loads and work up carefully. These loads were safe in our test pistol.

7mm INTERNATIONAL RIMMED


0.5060 in. [12.85 mm]
0.4215 in. [10.71 mm]
0.3100 in. [7.87 mm]
angle 38°
0.4020 in. [10.21 mm]
0.0630 in. [1.60 mm]
1.4830 in. [37.67 mm]
1.5400 in. [39.12 mm]
2.0390 in. [51.79 mm]

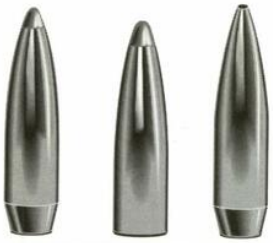
Max. Case Length: 2.039"
Trim-to Length: 2.029"
Max. Cart. Length: N/A
RCBS Shellholder: #2
Barrel Length: 10"
Twist: 1-9"

Test Firearm: Sterling Single Shot
Case: Federal
Primers: CCI 200

.284" Dia. **115 Grain** Sect. Density .204	**7mm HP**					
Ballistic Coefficient	0.257					
C.O.L. Tested At	2.680"					
Speer Part No.	1617					

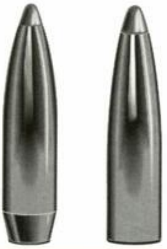
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748	**40.0C**	**2396**	**H335**	**37.0**	**2271**	**IMR 4064**	**40.0**	**1674**
	38.0	2155		35.0	2105		38.0	1566
BL-C(2)	**41.0**	**2395**	**H322**	**34.0**	**2268**	**IMR 4895**	**27.0**	**1614**
	39.0	2199		32.0	2100		25.0	1434

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.284" Dia. **145 Grain** Sect. Density .257	**7mm BT Spitz-SP**	**7mm Spitz-SP**	**7mm BT HP-Match**			
Ballistic Coefficient	0.502	0.457	0.465			
C.O.L. Tested At	2.760"	2.760"	2.760"			
Speer Part No.	1628	1629	1631			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)	**36.0**	**2120**	**H335**	**32.0**	**2045**	**IMR 4064**	**28.0**	**1652**
	34.0	1926		30.0	1897		26.0	1458
748	**35.0**	**2073**	**H322**	**29.0**	**1923**	**IMR 4895**	**28.0**	**1620**
	33.0	1959		27.0	1706		26.0	1450



.284" Dia. **160 Grain** Sect. Density .284	**7mm BT Spitz-SP**	**7mm Spitz-SP**				
Ballistic Coefficient	0.556	0.502				
C.O.L. Tested At	2.760"	2.760"				
Speer Part No.	1634	1635				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
BL-C(2)	**34.0**	**1988**	**H335**	**30.0**	**1898**	**IMR 4064**	**29.0**	**1674**
	32.0	1872		28.0	1770		27.0	1568
748	**33.0**	**1975**	**H322**	**28.0**	**1868**	**IMR 4895**	**28.0**	**1658**
	31.0	1765		26.0	1744		26.0	1503

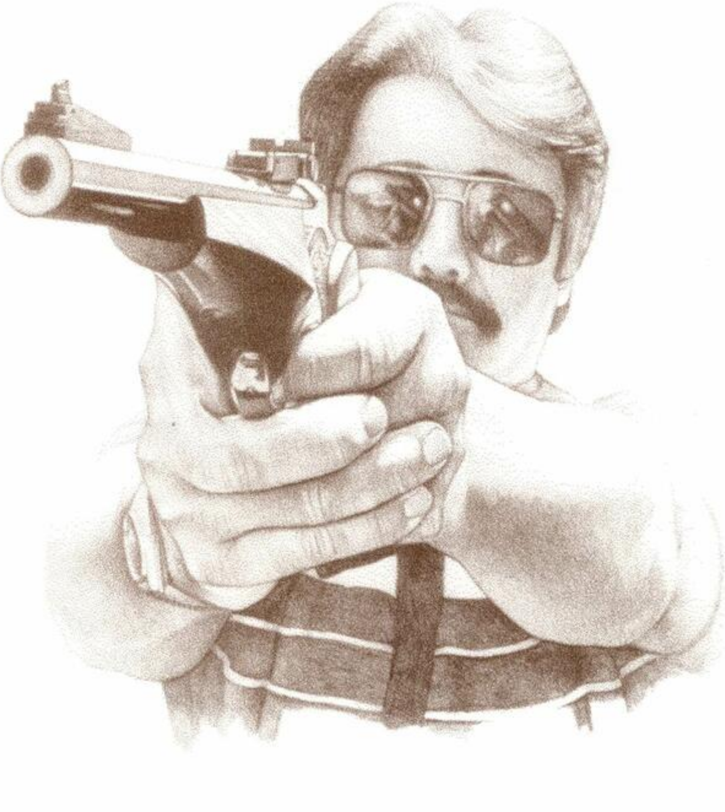
Notes: Bold print denotes maximum loads. They should be used with caution.

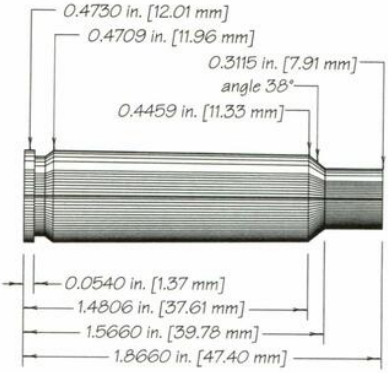
7mm IHMSA

The 7mm IHMSA is one of eight cartridges that Elgin Gates developed based on the 308 Winchester case. The 7mm IHMSA's generous case capacity gives it a significant velocity advantage over the 7mm T/CU.

Case forming is accomplished by full-length resizing of 308 Winchester or 300 Savage cases in a 7mm IHMSA die and then trimming to 1.861". Fire-forming completes the forming operations. IHMSA also sells a basic case which can be used to form any of the IHMSA cartridges.

In addition to its use in unlimited class IHMSA competition, the 7mm IHMSA makes a respectable hunting cartridge for game up to whitetail deer. Loaded with the 110 grain TNT or the 115 grain hollow point, the 7mm IHMSA also makes a fine varmint cartridge.




0.4730 in. [12.01 mm]
0.4709 in. [11.96 mm]
0.3115 in. [7.91 mm]
angle 38°
0.4459 in. [11.33 mm]
0.0540 in. [1.37 mm]
1.4806 in. [37.61 mm]
1.5660 in. [39.78 mm]
1.8660 in. [47.40 mm]

Max. Case Length: 1.866"
Trim-to Length: 1.856"
Max. Cart. Length: 2.750"
RCBS Shellholder: #3
Barrel Length: 15"

Test Firearm: Wichita Custom
Case: IHSMA
Primers: CCI 200, 250

.284" Dia. **115 Grain** Sect. Density .204	**7mm HP**					
Ballistic Coefficient	0.257					
C.O.L. Tested At	2.690"					
Speer Part No.	1617					

Note: Loads for the 115 grain HP may also be used for the .284" 110 grain TNT-HP bullet (part #1616).

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H322*	**36.0**	**2457**	**748***	**38.0**	**2307**			
	34.0	2319		36.0	2220			
BL-C(2)	**38.0**	**2337**	**IMR 4895**	**36.0**	**2284**			
	36.0	2184		34.0	2081			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.284" Dia. 145 Grain Sect. Density .257	7mm BT Spitz-SP	7mm Spitz-SP	7mm BT HP-Match			
Ballistic Coefficient	0.502	0.430	0.465			
C.O.L. Tested At	2.750"	2.750"	2.750"			
Speer Part No.	1628	1629	1631			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**38.0**	**2387**	**BL-C(2)***	**38.0**	**2343**	**IMR 3031**	**34.0**	**2179**
	36.0	2238		36.0	2209		32.0	2075
748*	**38.0**	**2355**	**H322***	**34.0**	**2323**	**IMR 4895**	**35.0**	**2174**
	36.0	2265		32.0	2206		33.0	2045

.284" Dia. 160 Grain Sect. Density .284	7mm BT Spitz-SP	7mm Spitz-SP				
Ballistic Coefficient	0.556	0.502				
C.O.L. Tested At	2.760"	2.760"				
Speer Part No.	1634	1635				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**38.0**	**2315**	**IMR 4064**	**35.0C**	**2193**	**IMR 4895**	**34.0**	**2092**
	36.0	2213		33.0	2017		32.0	1950
BL-C(2)*	**38.0**	**2254**	**H322***	**32.0**	**2153**	**H380**	**34.0**	**1899**
	36.0	2218		30.0	2079		32.0	1865

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

7-30 WATERS (HANDGUN)

Although developed for lever-action rifles, the 7-30 Waters is proving to be an effective handgun cartridge in the Thompson/Center Contender. With a 14-inch barrel, the cartridge can be used out to 150 yards on game animals up to the size of whitetail deer. The 110 grain TNT hollow point exiting the muzzle at nearly 2600 feet/sec gives excellent performance on varmints over the same ranges.

Many of the 7mm wildcat pistol cartridges equal the performance of the 7-30 in a handgun, but the 7-30 Waters is preferred by those who don't handload. The handloader has the advantage of being able to use spitzer bullets in the single-shot T/C, something the 7-30 lever-action rifle owner must absolutely avoid.

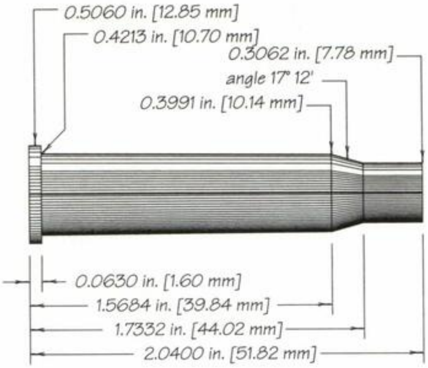
Velocity differences between our 24 inch Winchester rifle and the 14 inch Contender were small. With several powders, velocity loss in the pistol was less than 200 feet/sec.

The overall cartridge length used for these loads was the same as we used in the 7-30 rifle. Because the Contender usually has a relatively long throat, seating the bullets out somewhat may improve accuracy.

We do not list loads for bullets heavier than 145 grains. The velocities of heavy bullets in the pistol would be rather low, resulting in unreliable expansion and excessive bullet drop over the handgun's effective range.

Like many of the other single-shot pistol cartridges, we recommend that you neck size for top accuracy and case life. If factory 7-30 cases are hard to find, 30-30 cases can be full-length sized in a 7-30 Waters sizer die to give suitable brass.

For background information on the 7-30 Waters, see the rifle section. The operating pressure of the 7-30 Waters is 40,000 cup and these loads stay within that limit.


0.5060 in. [12.85 mm]
0.4213 in. [10.70 mm]
0.3062 in. [7.78 mm]
angle 17° 12'
0.3991 in. [10.14 mm]
0.0630 in. [1.60 mm]
1.5684 in. [39.84 mm]
1.7332 in. [44.02 mm]
2.0400 in. [51.82 mm]

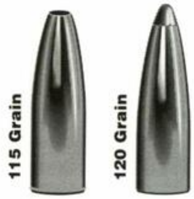
Max. Case Length: 2.040"
Trim-to Length: 2.030"
Max. Cart. Length: 2.550"
RCBS Shellholder: #2
Barrel Length: 14"
Twist: 1-9"

Test Firearm: T/C
Case: Federal
Primers: CCI 200, 250

.284" Dia. **110 Grain** Sect. Density .195	**7mm TNT-HP**					
Ballistic Coefficient	0.338					
C.O.L. Tested At	2.550"					
Speer Part No.	1616					

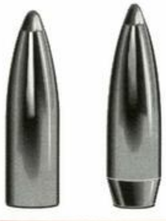
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**40.0**	**2597**	AA 2015BR	**33.0**	**2451**	Re15	**37.0**	**2421**
	36.0	2322		29.0	2253		33.0	2079
748*	**39.0**	**2463**	H4895	**36.0**	**2449**	IMR 3031	**34.0**	**2376**
	35.0	2191		32.0	2147		30.0	2124
Viht. N135	**35.0**	**2462**	H335*	**36.0**	**2422**	IMR 4895	**34.5**	**2375**
	31.0	2092		32.0	2216		30.5	2155

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.284" Dia. 115 Grain 120 Grain	7mm HP	7mm Spitz SP				
Sectional Density	0.204	0.213				
Ballistic Coefficient	0.257	0.386				
C.O.L. Tested At	2.550"	2.550"				
Speer Part No.	1617	1620				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re12	**37.0**	**2445**	**Re15**	**36.0**	**2386**	**AA 2230***	**30.0**	**2203**
	33.0	2228		32.0	2099		26.0	1998
748*	**37.0**	**2433**	**H335***	**34.0**	**2315**	**IMR 4895**	**32.0**	**2159**
	33.0	2175		30.0	2109		28.0	1940
Viht. N135	**34.0**	**2392**	**IMR 3031**	**33.0**	**2285**	**AA 2015BR**	**28.0**	**2126**
	30.0	2084		29.0	1982		24.0	1860



.284" Dia. 130 Grain Sect. Density .230	7mm Spitz-SP	7mm BT Spitz-SP				
Ballistic Coefficient	0.394	0.414				
C.O.L. Tested At	2.550"	2.550"				
Speer Part No.	1623	1624				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**35.5**	**2327**	**IMR 3031**	**33.0**	**2264**	**AA 2015BR**	**30.0**	**2208**
	31.5	2037		29.0	1967		26.0	1976
748*	**35.0**	**2304**	**Viht. N135**	**32.5**	**2260**	**AA 2230***	**30.0**	**2188**
	31.0	2005		28.5	1969		26.0	1951
H4895	**34.0**	**2294**	**H335***	**33.0**	**2212**	**Re7**	**27.0**	**2137**
	30.0	2022		29.0	1996		23.0	1914

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.284" Dia. 145 Grain Sect. Density .257	7mm BT Spitz-SP	7mm Spitz-SP	7mm BT HP-Match			
Ballistic Coefficient	0.502	0.457	0.465			
C.O.L. Tested At	2.550"	2.550"	2.550"			
Speer Part No.	1628	1629	1631			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re15	**35.0**	**2294**	**H4895**	**33.0**	**2202**	**IMR 3031**	**31.0**	**2092**
	31.0	2006		29.0	1947		27.0	1808
IMR 4895	**33.5**	**2237**	**AA 2015BR**	**30.0**	**2185**	**748***	**34.0**	**2066**
	29.5	1964		26.0	1908		30.0	1937
Viht. N135	**33.0**	**2225**	**H335***	**32.0**	**2094**	**Re7**	**25.0**	**1967**
	29.0	2002		28.0	1920		21.0	1726

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

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RIGHT

30 CARBINE (HANDGUN)

Although not a very effective rifle cartridge, the 30 carbine has found a following among handgunners. Since the cartridge was introduced, a number of custom pistols and revolvers have been built for this cartridge. However, its real popularity began when Ruger chambered the strong Blackhawk single-action revolver in 30 Carbine. For a time, Thompson/Center also chambered Contender barrels in 30 Carbine . More recently the 30 Carbine has been chambered in the AMT Automag III semi-auto pistol.

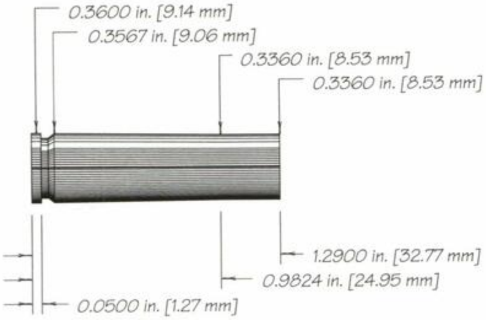
The 30 Carbine is in the same pressure class as the 357 Magnum. Because the case is slightly tapered, make sure that all traces of lubricant are removed from the cartridge and the revolver's chambers before firing. This will avoid locking up the cylinder when firing maximum loads. Using a carbide sizer die eliminates the need for case lube.

Speer's 110 grain round nose and spire point bullets can be loaded, but they will not give the expansion produced by the 100 Plinker and the 110 grain Varminter HP at pistol velocities. Bullets weighing more than 110 grains are not properly stabilized at these velocities. The 30 Carbine handgun has a well-earned reputation for muzzle blast. If you forget to put on your hearing protection, you'll quickly get an unpleasant reminder!

The 30 Carbine is best used as a varmint cartridge. For this purpose, its flat trajectory makes hitting targets easy at longer ranges. Both the Blackhawk and the Contender are more than accurate enough for small varmints. The 30 Carbine cartridge should not be used on deer-sized or larger animals.

Note that the data shows the use of small rifle primers. Cases should not be roll-crimped since headspacing is controlled by the case mouth. A light taper crimp is all that is needed. Best accuracy is obtained when cases are of uniform length.

For additional information on the 30 Carbine, see the rifle section.


0.3600 in. [9.14 mm]
0.3567 in. [9.06 mm]
0.3360 in. [8.53 mm]
0.3360 in. [8.53 mm]
1.2900 in. [32.77 mm]
0.9824 in. [24.95 mm]
0.0500 in. [1.27 mm]

Max. Case Length: 1.290"
Trim-to Length: 1.280"
Max. Cart. Length: 1.690"
RCBS Shellholder: #17
Barrel Length: 7.5"
Twist: 1-20"

Test Firearm: Ruger Blackhawk
Case: IMI
Primers: CCI 400, 450

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	1.620"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**15.5**	**1589**	IMR 4227	**14.5**	**1417**	Unique	**5.5**	**1142**
	14.5	1475		13.5	1312		4.5	938
296*	**15.5**	**1527**	Viht. N110	**13.0C**	**1394**	AA 1680	**16.0C**	**1126**
	14.5	1415		12.0	1306		15.0	1077
2400	**12.7**	**1476**	IMR 4198	**15.5C**	**1201**			
	11.7	1385		14.5	1116			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.308" Dia. **110 Grain** Sect. Density .136	**30** **RN-SP**	**30** **HP**				
Ballistic Coefficient	0.144	0.136				
C.O.L. Tested At	1.675"	1.675"				
Speer Part No.	1845	1835				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**14.7**	**1418**	**2400**	**11.2**	**1261**	**AA 1680**	**16.0**	**1040**
	13.7	1315		10.2	1132		15.0	973
IMR 4227	**14.5**	**1387**	**Viht. N110**	**12.5**	**1253**	**Unique**	**5.5**	**945**
	13.5	1281		11.5	1164		4.5	779
296	**15.0**	**1363**	**IMR 4198**	**15.0**	**1046**			
	14.0	1259		14.0	967			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

30-30 WINCHESTER (HANDGUN)

The introduction of 30-30 barrels for the Thompson/Center Contender gave handgun hunting a real boost. Although not a powerful as some wildcat 30 caliber single-shot cartridges like the 30 Herrett and the 309 JDJ, the 30-30 has the advantage of nearly universal ammo and brass availability. Within its range limitations the 30-30 pistol is suitable for most deer and the 125 grain TNT or the 110 grain Varminter HP have an explosive effect on varmints.

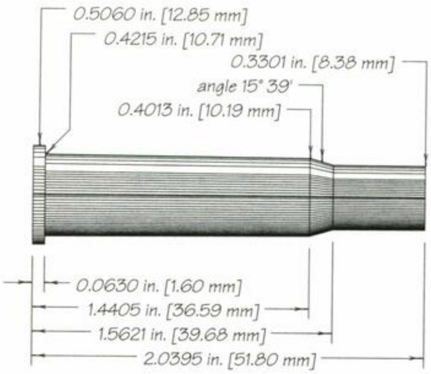
T/C barrels have been available in both 10- and 14-inch lengths. The blast and recoil in the shorter barrel may prove more than some people care to experience. The cartridge offers improved performance and shows much better manners in the longer barrel. Previous Speer manuals showed velocities in a 10 inch barrel. We chose the 14-inch this time because it has become more popular. Measured velocities from the 14-inch barrel were surprising high—not too far behind typical carbine velocities.

Terry Thompson, CCI/Speer Product Line Manager, and a nice antelope he took with a 30-30 custom Ruger pistol. (150 gr. Hot-Cor spitzer)

The overall cartridge lengths for the 125 and 150 grain bullets are greater than those used in a 30-30 rifle and exceed the industry length specification. Because the Contender is a single-shot with a generous throat, we seated the bullets out for better accuracy.

Neck sizing is recommended for the 30-30 Contender. For best results keep the neck-sized pistol cases separate from your 30-30 rifle cases.

In 10 inch barrels, the 130 and 150 grain flat point bullets expand better than spitzers and round nose bullets. This is due to their thinner jacket construction and larger exposed lead tip. Spitzer bullets can be used in the 14 inch barrels if desired. Like other rifle cartridges fired in handguns, rifle primers are recommended.


0.5060 in. [12.85 mm]
0.4215 in. [10.71 mm]
0.3301 in. [8.38 mm]
angle 15° 39'
0.4013 in. [10.19 mm]
0.0630 in. [1.60 mm]
1.4405 in. [36.59 mm]
1.5621 in. [39.68 mm]
2.0395 in. [51.80 mm]

Max. Case Length: 2.039"
Trim-to Length: 2.029"
Max. Cart. Length: see text
RCBS Shellholder: #2
Barrel Length: 14"
Twist: 1-10"

Test Firearm: Thompson/Center Contender
Case: W-W
Primers: CCI 200, 250

.308" Dia. **110 Grain** Sect. Density .166	**30 HP**	**30 RN-SP**	**30 Carb. RN-FMJ**	**30 Spire-SP**		
Ballistic Coefficient	0.136	0.144	0.179	0.273		
C.O.L. Tested At	2.415"	2.415"	2.415"	2.530"		
Speer Part No.	1835	1845	1846	1855		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**34.0**	**2618**	**748***	**40.0C**	**2343**	**IMR 4895**	**35.0**	**2206**
	30.0	2356		36.0	2111		31.0	1884
H322	**35.0**	**2373**	**AA 2015BR**	**34.0**	**2340**	**H4895**	**34.0**	**2165**
	31.0	2003		30.0	1974		30.0	1853
Re12	**38.0C**	**2352**	**IMR 4064**	**37.0C**	**2266**	**Viht. N133**	**31.0**	**2153**
	34.0	2140		33.0	1912		27.0	1817

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

125 Grain
130 Grain
130 Grain

.308" Dia. **125 Grain** **130 Grain**	**30 TNT-HP**	**30 HP**	**30 Flat-SP**			
Sectional Density	0.188	0.195	0.195			
Ballistic Coefficient	0.326	0.263	0.248			
C.O.L. Tested At	2.740"	2.730"	2.550"			
Speer Part No.	1986	2005	2007			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**31.0**	**2328**	**H322**	**33.0**	**2260**	**Re12**	**34.0**	**2058**
	27.0	2095		29.0	1908		30.0	1872
AA 2460*	**34.0**	**2313**	**Viht. N140**	**35.0**	**2101**	**IMR 4895**	**32.0**	**1975**
	30.0	2037		31.0	1868		28.0	1686
AA 2520*	**35.0**	**2296**	**748***	**35.5**	**2096**	**IMR 4064**	**33.0**	**1937**
	31.0	2060		31.5	1889		29.0	1634

.308" Dia. **150 Grain** Sect. Density .225	**30 Flat-SP**	**30 RN-SP**	**30 BT Spitz-SP**	**30 Spitz-SP**	**30 MT-SP**	
Ballistic Coefficient	0.268	0.266	0.423	0.384	0.301	
C.O.L. Tested At	2.550"	2.600"	2.700"	2.700"	2.650"	
Speer Part No.	2011	2017	2022	2023	2025	

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
748*	**37.0**	**2171**	**Re12**	**33.0**	**2103**	**H335***	**32.0**	**2024**
	33.0	1956		29.0	1913		28.0	1841
Re7	**29.0**	**2144**	**Viht. N140**	**34.0**	**2078**	**IMR 4895**	**31.0**	**1955**
	25.0	1931		30.0	1847		27.0	1669
H322	**31.0**	**2110**	**AA 2520***	**35.0**	**2066**	**IMR 4198**	**26.0**	**1458**
	27.0	1780		31.0	1853		24.0	1287

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

[32 Colt New Police]

32 S&W LONG

The 32 S&W Long Cartridge dates to the turn of the century when it was introduced in Smith & Wesson's First Model Hand Ejector revolver. Colt and other manufacturers—both domestic and European—soon picked up the cartridge and both break-top and solid frame revolvers were chambered for the new 32 Long.

Current factory ammunition is loaded with a 98 grain lead round nose bullet at a nominal velocity of 705 feet/sec. Federal also loads a 98 grain wadcutter for target use. This cartridge is capable of fine accuracy in a quality handgun. In fact, the 32 S&W Long wadcutter load is still a popular European target cartridge in high-grade match pistols such as the semi-automatic Walther GSP.

Speer makes two bullets which are appropriate for reloading the 32 S&W Long. The .312" 100 grain JHP can be used for plinking and small game hunting. Be sure to apply a heavy crimp and use the recommended loads only in quality revolvers which have a barrel/cylinder gap of .008" or smaller to avoid leaving a bullet in the bore. Note that several propellants are marked "DNR" which stands for "do not reduce". Reduced loads with these propellants produced velocities too low for jacketed bullets.

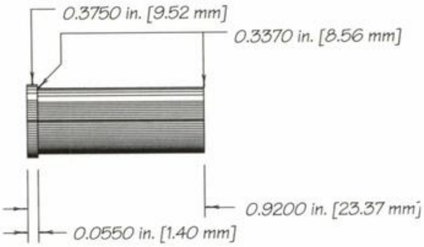
The Speer 98 grain hollow base wadcutter is a very accurate bullet designed for target use. The HBWC should be seated flush with the case mouth and lightly crimped. The loads shown for this bullet may not necessary reach maximum pressures but produced top accuracy in our test pistol. Do not exceed these load recommendations to avoid deforming the bullet base.

Data for the 100 grain JHP bullet can also be used with bullets cast from RCBS's 32 caliber 98 grain flat point bullet mould. These bullets are very accurate, and the flat point makes them effective on small game like rabbits.

The 32 S&W Long is identical to the 32 Colt New Police cartridge, but is not interchangeable with the 32 Long Colt cartridge. This RELOADING DATA IS FOR THE 32 S&W LONG AND 32 COLT NEW POLICE CARTRIDGES ONLY.

If you are unsure which of the various 32 cartridges your revolver requires, consult a qualified gunsmith. Also ask him to evaluate the revolver's quality before firing the gun. Many older or imported revolvers are unsafe to fire with any modern ammunition.

The SAAMI maximum pressure for the 32 Long is 12,000 cup.



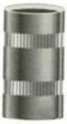
Max. Case Length: 0.920"
Trim-to Length: 0.910"
Max. Cart. Length: 1.280"
RCBS Shellholder: #23
Barrel Length: 6"
Twist: 1-18.75"

Test Firearm: Smith & Wesson K-32
Case: R-P
Primers: CCI 500

.312" Dia. **100 Grain** Sect. Density .147	**32 JHP**					
Ballistic Coefficient	0.167					
C.O.L. Tested At	1.185"					
Speer Part No.	3981					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**7.0**	**769**	**WAP**	**3.4**	**725**	**H. Universal**	**3.0**	**694**
	6.3	629		DNR	DNR		DNR	DNR
AA #9	**5.6**	**769**	**HS-6**	**4.1**	**720**	**231**	**2.6**	**676**
	5.1	663		DNR	DNR		2.4	662
296	**6.6**	**742**	**WSF**	**3.0**	**715**	**AA #5**	**3.8**	**675**
	6.0	635		DNR	DNR		DNR	DNR
2400	**5.5**	**733**	**Viht. 3N37**	**3.5**	**700**			
	5.0	660		DNR	DNR			

Notes: Bold print denotes maximum loads. They should be used with caution.
DNR = Do Not Reduce.



Note: Velocities for the 98 gr. HB-WC were recorded using a Walther GSP target pistol, (4" barrel).

.314" Dia. **98 Grain** Sect. Density .141	**32** **HB-WC**					
Ballistic Coefficient	0.044					
C.O.L. Tested At	0.920"					
Speer Part No.	4600					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Bullseye	**1.8**	**777**	**Herco**	**2.2**	**758**	**PB**	**1.7**	**735**
	1.6	674		2.0	700		1.5	649
Red Dot	**1.8**	**771**	**AA #5**	**2.7**	**756**	**Unique**	**2.0**	**733**
	1.6	703		2.5	701		1.8	663
HP-38	**1.9**	**765**	**231**	**1.9**	**739**	**700X**	**1.7**	**733**
	1.7	689		1.7	672		1.5	720

Notes: Bold print denotes maximum loads. They should be used with caution.

32 H&R MAGNUM

The 32 H&R Magnum was introduced in 1983 by Harrington & Richardson and Federal as a more powerful version of the 32 S&W Long cartridge. At first, H&R was the only maker of 32 Magnum revolvers but soon Ruger modified its popular rimfire Single-Six single-action to centerfire and chambered it for the 32 Magnum. Since then, Smith & Wesson, Dan Wesson, Charter and several imported revolvers have been chambered for this cartridge. Revolvers chambered for the 32 Magnum can also fire 32 S&W Long ammunition.

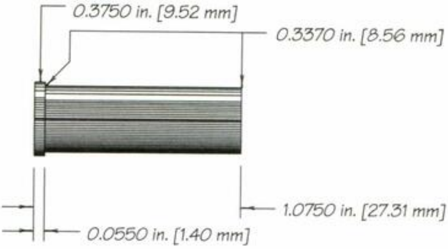
The extra power of the 32 Magnum compared to the 32 S&W Long makes it a much better field cartridge. The .312" Speer 100 grain JHP will expand well at maximum load levels and its trajectory is flat enough to make long shots easier. Factory ammunition is loaded by Federal with either an 85 grain JHP or a 95 grain lead semi-wadcutter. In our test revolver, the 95 grain factory load chronographed at 1030 ft/sec and the 85 grain load clocked at 1090 feet/sec. The little Ruger with its adjustable sights was quite accurate even at ranges beyond 100 yards.

The reloader can obtain more energy than factory ammo by using the Speer 100 grain bullet. A quick glance at the data will show that this bullet can be safely driven at over 1100 ft/sec and top loads produced nearly 290 foot-pounds of energy. When using slower burning powders, be sure to give the bullet a heavy crimp to insure reliable ignition and consistent performance. The data may also be used with the .308" 100 grain Speer Plinker™. However, the expander plug in your die should be no larger than .307" for the case to properly grip the bullet.

Federal discontinued selling any new, unprimed cases several years ago. However, Starline (Sedalia, MO) now offers 32 Magnum brass to handloaders.

The 98 grain wadcutter loads are not loaded to maximum pressure, but are the highest charge weights that should be used to avoid deformation of the bullet base and still provide good accuracy.

The SAAMI maximum pressure for the 32 H&R Magnum is 21,000 cup (slightly higher than the 38 Special +P). These loads fall within this limit.



Max. Case Length: 1.075"
Trim-to Length: 1.065"
Max. Cart. Length: 1.350"
RCBS Shellholder: #23
Barrel Length: 5.50"
Twist: 1-16"

Test Firearm: Ruger Single Six
Case: FC
Primers: CCI 500

Note: Data may be used with the .308" 100 gr. Plinker®; see text for information.

.312" Dia. **100 Grain** Sect. Density .147	**32** **JHP**					
Ballistic Coefficient	0.167					
C.O.L. Tested At	1.345"					
Speer Part No.	3981					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**10.5**	**1140**	**2400**	**7.7**	**1091**	**296**	**9.9**	**1059**
	9.5	1039		7.0	987		9.0	1020
H. Universal	**4.5**	**1110**	**AA #9**	**7.8**	**1090**	**WAP**	**5.0**	**1059**
	4.0	998		7.1	1017		4.5	940
Herco	**4.7**	**1104**	**HS-6**	**6.1**	**1088**	**WSF**	**4.5**	**1045**
	4.3	985		5.5	978		4.0	940
AA #5	**5.7**	**1096**	**Viht. N110**	**9.0**	**1080**	**Red Dot**	**3.6**	**1018**
	5.2	979		8.1	970		3.2	935
AA #7	**6.9**	**1094**	**Unique**	**4.4**	**1074**	**Bullseye**	**3.6**	**1000**
	6.3	1025		3.9	978		3.1	899

Notes: Bold print denotes maximum loads. They should be used with caution.

.314" Dia. **98 Grain** Sect. Density .141	**32** **HB-WC**					
Ballistic Coefficient	0.044					
C.O.L. Tested At	1.075"					
Speer Part No.	4600					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #5	**3.4**	**843**	**Bullseye**	**2.3**	**810**	**700-X**	**2.2**	**792**
	3.2	783		2.1	752		2.0	735
Unique	**3.0**	**814**	**Red Dot**	**2.3**	**805**	**Green Dot**	**2.5**	**791**
	2.8	770		2.1	735		2.3	751
PB	**2.4**	**812**	**HP-38**	**2.5**	**801**	**231**	**2.4**	**778**
	2.2	760		2.3	740		2.2	742

Notes: Bold print denotes maximum loads. They should be used with caution.

32-20 (T/C CONTENDER ONLY)

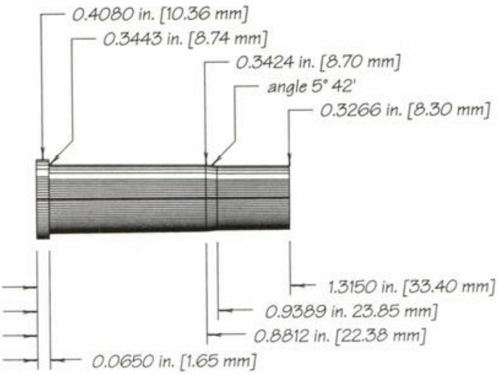
The interest in metallic silhouette handgun competition caused shooters to look at a number of different case configurations. Even some old, nearly obsolete cartridges were given a second look. One of these was the 32-20. For the Field Pistol class where the longest shots are 100 meters, a small cartridge with light recoil and reasonable velocity seemed like a good idea. The 32-20, if carefully loaded over SAAMI pressure limits, would topple targets with regularity.

Thompson/Center introduced 32-20 barrels for their excellent Contender single-shot pistol. They chose to make the groove diameter .308" (instead of the standard .311" size) to allow more flexibility in the choice of bullets. The Contender gives excellent accuracy with Speer bullets from 100 to 130 grains.

In order to load .308" bullets in the 32-20, it is necessary to replace the original expander plug with one no larger than .307" for properly bullet grip. Contact your die manufacturer for the correct plug.

The 32-20 cartridge case is relatively thin compared to more modern cartridges. When loading to higher pressure, use new or once-fired cases. We recommend neck sizing to extend case life and improve accuracy.

IMPORTANT NOTE: These loads exceed SAAMI pressure limits by a considerable amount. They are for the Thompson/Center Contender ONLY. Do not use them in any other firearm chambered for the 32-20 cartridge. Do not substitute the Speer .312" 100 grain HP for the .308" Plinker.


0.4080 in. [10.36 mm]
0.3443 in. [8.74 mm]
0.3424 in. [8.70 mm]
angle 5° 42'
0.3266 in. [8.30 mm]
1.3150 in. [33.40 mm]
0.9389 in. 23.85 mm]
0.8812 in. [22.38 mm]
0.0650 in. [1.65 mm]

Max. Case Length: 1.315"
Trim-to Length: 1.305"
Max. Cart. Length: N/A
RCBS Shellholder: #1
Barrel Length: 10"
Twist: 1-10"

Test Firearm: T/C Contender
Case: W-W
Primers: CCI 500

Note: Do not substitute the .312" 100 gr. JHP (#3981) for the 100 gr. Plinker.

.308" Dia. **100 Grain** Sect. Density .151	**30** **RN-SP**					
Ballistic Coefficient	0.124					
C.O.L. Tested At	1.710"					
Speer Part No.	1805					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**17.0**	**1908**	**IMR 4227**	**16.5C**	**1831**	**Herco**	**9.1**	**1712**
	16.0	1734		15.5	1637		8.1	1587
296	**16.5**	**1897**	**2400**	**13.0**	**1793**	**IMR 4198**	**18.0C**	**1663**
	15.5	1646		12.0	1595		17.0	1527
AA #9	**14.0**	**1833**	**HS-6**	**10.1**	**1713**	**SR 4759**	**13.0C**	**1582**
	13.0	1666		9.1	1303		12.0	1326

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.308" Dia. 110 Grain

Sect. Density .166

	30 HP	30 RN-SP	30 Spire-SP			
Ballistic Coefficient	0.136	0.144	0.273			
C.O.L. Tested At	1.710"	1.710"	1.800"			
Speer Part No.	1835	1845	1855			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**16.0**	**1813**	**IMR 4227**	**16.0**	**1730**	**SR 4759**	**13.0C**	**1566**
	15.0	1598		15.0	1540		12.0	1279
296	**15.5**	**1765**	**2400**	**12.0**	**1594**	**Herco**	**8.4**	**1552**
	14.5	1610		11.0	1371		7.4	1472
AA #9	**13.5**	**1739**	**IMR 4198**	**17.0C**	**1576**	**HS-6**	**9.1**	**1539**
	12.5	1579		16.0	1375		8.1	1484

.308" Dia. 130 Grain

Sect. Density .195

	30 HP	30 Flat-SP				
Ballistic Coefficient	0.263	0.248				
C.O.L. Tested At	1.910"	1.865"				
Speer Part No.	2005	2007				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**15.0**	**1664**	**296**	**14.5**	**1602**	**IMR 4198**	**16.0C**	**1453**
	14.0	1479		13.5	1443		15.0	1339
IMR 4227	**15.5C**	**1645**	**SR 4759**	**13.0**	**1489**	**Herco**	**7.8**	**1387**
	14.5	1479		12.0	1256		6.8	1270
AA #9	**13.0**	**1632**	**2400**	**11.5**	**1488**	**HS-6**	**8.6**	**1340**
	12.0	1476		10.5	1234		7.6	1246

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

380 AUTO

The 380 Auto was introduced to U.S. shooters in 1908 when Colt chambered it in the Pocket Automatic, a compact and well-built pistol designed by John Browning. The cartridge was also introduced in Europe as the 9mm Browning Short. In an era when some people considered a 32 caliber a "big gun", the 380 Auto created quite a stir. It was compact enough to be chambered in any pistol which could handle the 32 Auto cartridge yet offered a distinct ballistic advantage.

Following the Second World War, no American gun makers chambered pistols for the 380 but there were plenty of new and surplus imported guns around. Factory ammunition was limited to a single load—a 95 grain FMJ bullet with a nominal muzzle velocity of 950 feet/sec. Because there is so much variation in chamber and bore dimensions, many factory loads do not meet this specification in production pistols.

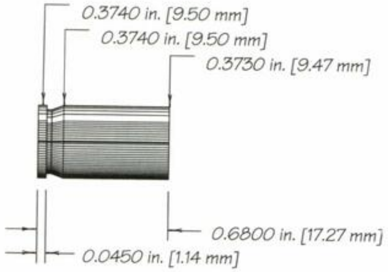
In the 1970's new, high-quality pistols began to appear on the market. At the same time, ammo makers offered hollow point bullets to improve the terminal effects of the cartridge. The 380 has always been a popular back-up gun for peace officers and is often chosen for home defense. It will never challenge the performance of the 9mm Luger but is far ahead of the 32 Auto for defense when loaded with modern JHP ammunition.

Most 380 pistols have rudimentary sights better suited for concealed carry, and trigger pulls are often heavy. As a result, the 380 isn't much of a target or hunting pistol. There are exceptions of course; quality Walthers, SIG's, Berettas and others can give exceptional accuracy with good ammo.

Although not as widely reloaded as other centerfire pistol cartridges, the 380 requires few special techniques other than a shorter loading block and a tight case neck fit (to avoid bullet set-back on feeding). There is now a good choice of .355" bullets for the 380, including the high-tech Speer Gold Dot 90 grain HP. The Speer 100 grain hollow point is also quite accurate in a good pistol, and offers somewhat more penetration than lighter bullets. The 95 grain TMJ is recommended for practice and plinking.

Earlier Speer manuals showed loads for 115 grain bullets designed for the 9mm Luger. However, the long nose of these bullets and the newer 115 grain Gold Dot could leave part of the case mouth unsupported when seated to the proper length in the 380 case. As a result, some reloaders encountered feeding problems so we have deleted these loads.

Because the 380 headspaces on the case mouth, light taper crimping is required. These loads do not exceed the 21,500 psi pressure limit established for the 380 by SAAMI.


0.3740 in. [9.50 mm]
0.3740 in. [9.50 mm]
0.3730 in. [9.47 mm]
0.6800 in. [17.27 mm]
0.0450 in. [1.14 mm]

Max. Case Length: 0.680"
Trim-to Length: 0.670"
Max. Cart. Length: 0.984"
RCBS Shellholder: #10
Barrel Length: 3.80"
Twist: 1-10"

Test Firearm: Walther PP
Case: W-W
Primers: CCI 500

.355" Dia. **90 Grain** Sect. Density .102	**9mm GD-HP**					
Ballistic Coefficient	0.101					
C.O.L. Tested At	0.970"					
Speer Part No.	3992					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #2	**3.9**	**1056**	Unique	**4.6C**	**1034**	700-X	**3.6**	**988**
	3.5	982		4.1	877		3.2	812
AA #7	**7.0C**	**1050**	231	**4.0**	**1031**	AA #5	**5.4**	**984**
	6.3	941		3.6	978		4.8	845
Viht. N320	**3.4**	**1044**	H. Universal	**4.3**	**994**	WSL	**3.6**	**972**
	3.1	953		3.8	821		3.2	825

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.355" Dia. **95 Grain** Sect. Density .108	**9mm** **TMJ**					
Ballistic Coefficient	0.131					
C.O.L. Tested At	0.970"					
Speer Part No.	4001					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
231	**4.0**	**1027**	**Viht. N320**	**3.4**	**998**	**AA #2**	**3.7**	**965**
	3.6	945		3.0	893		3.3	887
AA #7	**6.5**	**1019**	**Bullseye**	**3.3**	**990**	**WSL**	**3.5**	**960**
	5.9	971		3.0	874		3.1	849
700-X	**3.4**	**1012**	**H. Universal**	**4.1**	**979**	**AA #5**	**5.0**	**949**
	3.1	912		3.6	854		4.6	871
Unique	**4.2**	**1006**	**WAP**	**5.0**	**967**			
	3.8	918		4.4	841			

.355" Dia. **100 Grain** Sect. Density .113	**9mm** **JHP**					
Ballistic Coefficient	0.111					
C.O.L. Tested At	0.960"					
Speer Part No.	3983					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
WAP	**4.5**	**988**	**Viht. N320**	**3.2**	**953**	**231**	**3.6**	**922**
	4.0	889		2.8	826		3.2	844
Herco	**4.2**	**972**	**Unique**	**3.7**	**925**	**Bullseye**	**2.8**	**858**
	3.8	897		3.3	870		2.6	825

Notes: Bold print denotes maximum loads. They should be used with caution.

9x18mm MAKAROV

Relatively unknown until 1992, 9x18mm Makarov pistols and ammo appeared on the surplus market in this country after the break-up of the USSR. The Makarov pistol was adopted by several Eastern Bloc countries following World War II as a standard military and police sidearm replacing the 7.62mm Tokarev. The Stechkin selective-fire machine pistol was also chambered for the Makarov cartridge.

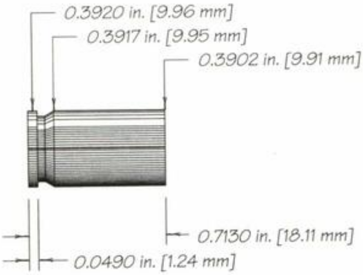
The 9x18mm cartridge is halfway between the case length of the 380 Auto and the 9mm Luger cartridges. However, in terms of performance, it is much closer to the 380. Surplus ammunition is loaded with 95-96 grain FMJ bullets and chronographs in the 940 to 1000 ft/sec range. Some reference books show Makarov velocities as high as 1115 ft/sec; however, CCI/Speer engineers have yet to encounter any surplus lots posting this kind of performance in a Makarov pistol.

The 9x18 Makarov is NOT a "true" 9mm. Rather than the common .355" diameter, the Makarov uses bullets of .364" diameter. Although this limits the handloader in bullet choice, Speer sells two bullets in this diameter which are suitable for the Makarov—a 95 grain TMJ for plinking and a 90 grain Gold Dot HP suitable for defense or small game hunting. RCBS offers a mould for a 100 grain, round-nose cast bullet.

Almost all imported ammunition and the new CCI Blazer ammo in this caliber are Berdan primed and aren't suitable for reloading. Boxer-primed reloadable cases are available from Starline (Sedalia, MO). Cases may also be formed from 9mm Luger brass. Trim resized Luger cases to .705" and use Makarov dies to expand the neck to hold .364" bullets. The first firing will form the case to the proper dimensions. Handloading techniques are the same as for any other semi-auto pistol cartridge which headspaces on the case mouth. Taper crimping is recommended.

Makarov pistols that we have examined seem to be well made and reasonably accurate, although the sights and trigger pulls are typically military. CCI was the first U.S. manufacturer to make Makarov ammunition and established the SAAMI pressure limit at 24,100 psi.

Editor's Note: Our thanks to Bob and Barbara Hayden of Starline for furnishing cases for this testing.


0.3920 in. [9.96 mm]
0.3917 in. [9.95 mm]
0.3902 in. [9.91 mm]
0.7130 in. [18.11 mm]
0.0490 in. [1.24 mm]

Max. Case Length: 0.713"
Trim-to Length: 0.703"
Max. Cart. Length: 0.984"
RCBS Shellholder: #16
Barrel Length: 4"
Twist: 1-10"

Test Firearm: Makarov (East German)
Case: Starline
Primers: CCI 500

.364" Dia. **90 Grain** Sect. Density .097	**9mm GD-HP**					
Ballistic Coefficient	0.107					
C.O.L. Tested At	0.970"					
Speer Part No.	3999					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #5	**6.7**	**1099**	**231**	**4.5**	**1074**	**Viht. N320**	**4.0**	**1054**
	6.0	970		4.0	971		3.6	962
Viht. N330	**4.7**	**1097**	**Bullseye**	**4.1**	**1067**	**AA #7**	**8.0C**	**1049**
	4.2	908		3.6	971		7.2	935
H. Universal	**4.8**	**1094**	**AA #2**	**4.5**	**1058**	**HS-6**	**6.5**	**1048**
	4.3	930		4.0	957		5.8	891

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.364" Dia. **95 Grain** Sect. Density .102	**9mm** **TMJ**					
Ballistic Coefficient	0.127					
C.O.L. Tested At	0.980"					
Speer Part No.	4375					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #5	**6.3**	**1068**	**231**	**4.4**	**1029**	**Viht. N330**	**4.5**	**966**
	5.6	891		3.9	911		4.0	841
AA #2	**4.4**	**1042**	**HS-6**	**6.3**	**1010**	**H. Universal**	**4.5**	**965**
	3.9	936		5.6	828		4.0	774
AA #7	**7.8**	**1038**	**Bullseye**	**3.9**	**1010**	**Viht. N320**	**3.7**	**963**
	7.0	912		3.5	896		3.3	832

Notes: Bold print denotes maximum loads. They should be used with caution.

9mm LUGER

The 9mm Luger cartridge is known by several names including 9mm Parabellum and 9x19mm. Some pistols chambered for this cartridge are marked "9mm/08" or "9mm P/08" to indicate the date (1908) when it was adopted by the German Army. Except for war souvenirs, there were few 9mm pistols in the U.S. until the 1950's.

The U.S. military considered the 9mm as a service cartridge on numerous occasions and finally adopted it in 1985 in the M-9 Beretta pistol. The compact pistols and the high magazine capacity found in many models have combined to make the 9mm Luger the most popular cartridge in the U.S. law enforcement community also.

The 9mm was originally loaded with full metal jacketed bullets for reliable feeding. However, to succeed as a police service cartridge, it was necessary to use expanding bullets to limit the tremendous penetration of the FMJ 9mm bullets. The current trend in law enforcement is toward 124 and 147 grain JHP bullets.

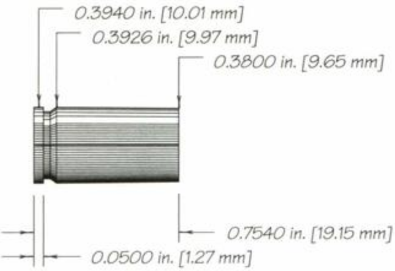
Speer offers a number of bullets which are suitable for the 9mm. The 100 grain JHP bullet is excellent for varmints and small game. For general purpose shooting and target practice, the 115 and 124 grain TMJ bullets are a good choice. The 115, 124 and 147 grain Gold Dot hollow points should be chosen for serious defense work. We have previously listed 9mm Luger loads for the 88 grain JHP and the 95 grain TMJ, but many reloaders found the resulting short overall length cause feeding problems.

When loading the 9mm, carefully observe the cartridge overall lengths listed in the data. UNDER NO CONDITIONS SHOULD THE BULLETS BE LOADED SHORTER THAN THE LISTED LENGTHS. 9mm case capacity is relatively small and seating a bullet deeper than indicated can cause excessive pressures and the potential for damage or injury.

Loads listed for the Speer 125 grain lead bullet generally do not operate at maximum pressure. We have limited the velocity to around 1000 feet/sec to reduce barrel leading. A good rule of thumb with swaged lead bullets is to use the lightest load which will cycle the action reliably.

The 9mm Luger headspaces on the case mouth so roll crimping is not recommended. A good taper crimp will give sufficient holding power as long as the expander ball is no larger than 0.354 inches. The taper crimp also gives a nicely finished edge to the case mouth for reliable feeding. Refer to the section, "Loading for Semi-automatic Pistols" in the introduction to the handgun data. There you will find an extended discussion on reloading the 9mm Luger which contains some helpful tips.

The listed loads do not exceed the industry maximum pressure of 35,000 psi.



Max. Case Length: 0.754"
Trim-to Length: 0.744"
Max. Cart. Length: 1.168"
RCBS Shellholder: #16
Barrel Length: 4"
Twist: 1-10"

Test Firearm: Smith & Wesson Model 5906
Case: Speer
Primers: CCI 500

.355" Dia. **100 Grain** Sect. Density .113	**9mm JHP**					
Ballistic Coefficient	0.111					
C.O.L. Tested At	1.050"					
Speer Part No.	3983					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**8.2**	**1296**	**HS-6**	**7.5**	**1228**	**AA #2**	**5.1**	**1204**
	7.4	1148		6.7	1091		4.6	1050
AA #5	**7.4**	**1274**	**Bullseye**	**4.8**	**1217**	**Viht. 3N37**	**6.4**	**1203**
	6.7	1150		4.3	1134		5.7	1100
AA #7	**9.6C**	**1272**	**WAP**	**6.4**	**1210**	**WSF**	**5.6**	**1189**
	8.6	1190		5.7	1100		5.0	1097
Viht. N350	**6.3**	**1229**	**Unique**	**5.9**	**1207**	**231**	**5.2**	**1179**
	5.6	1137		5.3	1163		4.5	997

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.355" Dia.
115 Grain

Sect. Density .130

	9mm GD-HP	9mm TMJ	9mm JHP			
Ballistic Coefficient	0.125	0.177	0.118			
C.O.L. Tested At	1.125"	1.135"	1.125"			
Speer Part No.	3994	3995	3996			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**8.5**	**1258**	**AA #7**	**9.6**	**1220**	**WSF**	**5.6**	**1156**
	7.7	1161		8.6	1158		5.0	1041
WAP	**6.7**	**1245**	**Viht. N350**	**6.5**	**1210**	**Bullseye**	**4.7**	**1144**
	6.0	1162		5.8	1109		4.2	1037
Unique	**6.3**	**1244**	**HS-6**	**7.5**	**1178**	**231**	**5.0**	**1133**
	5.6	1166		6.7	1048		4.5	1026
Viht. 3N37	**6.8**	**1225**	**H. Universal**	**5.3**	**1172**	**AA #5**	**6.8**	**1102**
	6.1	1128		4.7	1046		6.1	1003

.355" Dia.
124 Grain

Sect. Density .141

	9mm SP	9mm GD-HP	9mm TMJ			
Ballistic Coefficient	0.115	0.134	0.114			
C.O.L. Tested At	1.120"	1.120"	1.135"			
Speer Part No.	3997	3998	4004			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-7	**8.9**	**1249**	**AA #7**	**9.0**	**1180**	**AA #5**	**6.5**	**1069**
	8.0	1159		8.1	1077		5.8	963
Blue Dot	**7.9**	**1238**	**Viht. 3N37**	**6.4**	**1179**	**Bullseye**	**4.4**	**1059**
	7.1	1121		5.7	1063		3.9	966
AA #9	**10.5C**	**1185**	**WAP**	**6.0**	**1138**	**HS-6**	**6.7**	**1059**
	9.4	1061		5.4	1019		6.0	951
Unique	**5.8**	**1180**	**H. Universal**	**5.0**	**1089**	**231**	**4.5**	**998**
	5.2	1080		4.5	993		4.0	887

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.355" Dia. 147 Grain Sect. Density .167	9mm GD-HP	9mm TMJ				
Ballistic Coefficient	0.164	0.208				
C.O.L. Tested At	1.130"	1.130"				
Speer Part No.	4002	4006				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**5.8**	**1001**	**AA #7**	**6.8**	**961**	**HS-7**	**6.8**	**953**
	5.1	900		6.1	867		6.1	866
Viht. 3N37	**4.9**	**969**	**HS-6**	**5.6**	**956**	**WSF**	**4.1**	**931**
	4.4	886		5.0	845		3.6	840
WAP	**4.7**	**964**	**Unique**	**4.3**	**954**	**AA #5**	**5.1**	**931**
	4.2	879		3.8	852		4.5	821

.356" Dia. 125 Grain Sect. Density .142	9mm L-RN					
Ballistic Coefficient	0.155					
C.O.L. Tested At	1.130"					
Speer Part No.	4601					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
WAP	**4.6**	**1012**	**HP-38**	**4.2**	**995**	**231**	**4.1**	**982**
	4.2	921		3.9	917		3.8	911
Unique	**4.5**	**1007**	**HS-6**	**5.5**	**993**	**700-X**	**3.4**	**977**
	4.1	911		5.1	913		3.2	920
Red Dot	**3.6**	**1004**	**H. Universal**	**4.3**	**991**	**Bullseye**	**3.8**	**962**
	3.3	888		3.9	899		3.5	929

Notes: Bold print denotes maximum loads. They should be used with caution.

38 SUPER AUTO +P

The 38 Super cartridge is an improved version of the Colt 38 Auto (or 38 ACP) cartridge. The original version was introduced in 1900 in the Colt 38 Automatic Pistol and propelled a 130 grain FMJ bullet at a leisurely 1050 feet/sec. The cartridge was capable of better performance but the original pistol was not designed for high-pressure ammo. Thus Colt introduced the 38 Super Auto pistol in 1929.

The new pistol used the strong M1911 frame and could handle higher pressure. With the added pressure, the cartridge was capable of pushing the same 130 grain bullet at 1280 feet/sec which was very impressive performance in those days. It was renamed the 38 Super Auto, or 38 Super for short.

The rising popularity of the 9mm Luger diminished the popularity of the Super in some markets. However, today the Super has gained a tremendous following among competition shooters. IPSC shooters want the power of a 45 Auto but with lighter recoil and higher magazine capacity. Because the 9mm Luger cartridge lacks sufficient propellant capacity to accomplish this, competitors and custom pistolsmiths turned to the 38 Super.

VIHTAVUORI OY
SMOKELESS POWDER
GUN
CL
VIHTAVUORI OY
TEAM

Steve Thornton, competition shooter uses RCBS equipment to handload his match ammo.

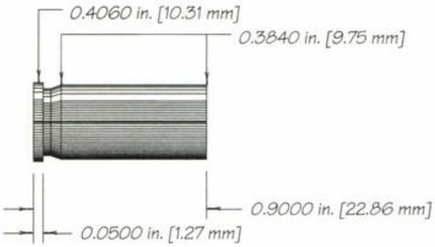
To make USPSA/IPSC major power factor (weight x velocity = 175,000) the Super must be loaded over existing SAAMI pressure standards. We cannot recommend this practice in stock, out-of-the-box pistols. Nearly all custom pistols firing high-pressure 38 Super loads have modified frames and special barrels to provide better support of the cartridge case. If you wish to shoot the 38 Super beyond SAAMI pressures, we strongly recommend that you consult a pistolsmith who specializes in building high-performance 38 Super pistols.

In its standard form, the 38 Super is a fine field pistol cartridge. Loaded with 100 or 115 grain hollow points, it is an effective small game cartridge. The 124 and 147 grain Gold Dot hollow points are excellent for self-defense and provide more energy than the 9mm Luger with the same bullets.

For years, 38 Super pistols seemed capable of only mediocre accuracy. The problem was traced to the way most production pistols were headspaced. This has now been remedied. For an excellent discussion of this subject, please consult Bill Corson's article in issue #71 of the *Handloader* magazine. Reprints are available for sale from Wolfe Publishing (6471 Airpark Drive, Prescott, AZ 86301).

In 1974, SAAMI adopted the +P headstamp for cartridges having two pressure limits. Because the 38 Super is identical in appearance to the older 38 Auto cartridge, the +P designator was added to the Super case to avoid confusion. The following loads do not exceed the 33,000 c.u.p. pressure limit established by SAAMI, for the +P version.

THESE LOADS ARE NOT FOR USE IN COLT MODELS 1900 AND 1902 PISTOLS. If in doubt as to your pistol's identity, have it checked by a qualified gunsmith.



Max. Case Length: 0.900"
Trim-to Length: 0.890"
Max. Cart. Length: 1.280"
RCBS Shellholder: #39
Barrel Length: 5"
Twist: 1-16"

Test Firearm: Colt 38 Super
Case: W-W
Primers: CCI 500

.355" Dia. **100 Grain** Sect. Density .114	**9mm JHP**					
Ballistic Coefficient	0.095					
C.O.L. Tested At	1.215"					
Speer Part No.	3983					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**10.6C**	**1481**	**AA #9**	**13.4C**	**1417**	**HS-6**	**9.4**	**1387**
	9.6	1333		12.4	1283		8.5	1308
AA #5	**9.0**	**1452**	**Viht. 3N37**	**8.0**	**1409**	**Herco**	**8.1**	**1380**
	8.1	1265		7.2	1281		7.3	1261
AA #7	**11.2**	**1429**	**WAP**	**8.0**	**1388**	**H. Universal**	**6.5**	**1375**
	10.2	1329		7.2	1292		5.9	1240

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.355" Dia. **115 Grain** Sect. Density .130	**9mm** **GD-HP**	**9mm** **TMJ**	**9mm** **JHP**			
Ballistic Coefficient	0.125	0.117	0.114			
C.O.L. Tested At	1.260"	1.280"	1.260"			
Speer Part No.	3994	3995	3996			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**10.0C**	**1362**	**Viht. 3N37**	**7.7**	**1323**	**WAP**	**7.6**	**1278**
	9.0	1265		7.0	1188		7.3	1066
AA #7	**10.5**	**1328**	**WSF**	**6.8**	**1282**	**Herco**	**7.8C**	**1276**
	9.5	1219		6.2	1164		7.0	1232
AA #9	**12.7C**	**1324**	**H. Universal**	**6.3**	**1278**	**HS-6**	**8.8**	**1307**
	11.7	1222		5.7	1145		8.0	1177

.355" Dia. **124 Grain** Sect. Density .141	**9mm** **SP**	**9mm** **GD-HP**	**9mm** **TMJ**			
Ballistic Coefficient	0.115	0.134	0.114			
C.O.L. Tested At	1.260"	1.260"	1.280"			
Speer Part No.	3997	3998	4004			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**9.2**	**1312**	**Unique**	**6.2**	**1208**	**AA #7**	**9.9**	**1169**
	8.3	1182		5.6	1127		9.0	1058
Herco	**7.3**	**1272**	**H. Universal**	**5.9**	**1202**	**Bullseye**	**5.2**	**1158**
	6.7	1176		5.3	1078		4.7	1073
AA #9	**12.0C**	**1267**	**Viht. 3N37**	**7.1**	**1198**	**700-X**	**5.0**	**1132**
	11.0	1187		6.4	1092		4.5	1050
HS-6	**8.3**	**1245**	**WAP**	**7.1**	**1193**	**Green Dot**	**5.3**	**1125**
	7.5	1134		6.4	1105		4.8	1051
AA #5	**8.0**	**1213**	**WSF**	**6.1**	**1184**	**231**	**5.3**	**1117**
	7.2	1102		5.6	1057		4.8	1021

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.355" Dia. **147 Grain** Sect. Density .167	**9mm GD-HP**	**9mm TMJ**				
Ballistic Coefficient	0.164	0.208				
C.O.L. Tested At	1.275"	1.275"				
Speer Part No.	4002	4006				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #9	**10.5**	**1122**	**AA #7**	**8.2**	**1061**	**231**	**4.8**	**1008**
	9.5	1021		7.4	914		4.3	899
2400	**9.5**	**1099**	**HS-6**	**7.1**	**1048**	**AA #5**	**6.4**	**1004**
	8.5	960		6.4	948		5.8	910
WAP	**6.3**	**1091**	**Unique**	**5.4**	**1043**	**HP-38**	**4.8**	**992**
	5.7	1017		4.9	984		4.3	919
Viht. 3N37	**6.2**	**1081**	**WSF**	**5.3**	**1029**	**Red Dot**	**4.3**	**989**
	5.2	979		4.8	938		3.8	910
H. Universal	**5.2**	**1065**	**AA #2**	**5.1**	**1021**	**Herco**	**5.3**	**970**
	4.7	961		4.6	941		4.8	847

.356" Dia. **125 Grain** Sect. Density .141	**9mm L-RN**					
Ballistic Coefficient	0.155					
C.O.L. Tested At	1.260"					
Speer Part No.	4601					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-7	**9.0**	**1255**	**Bullseye**	**5.4**	**1215**	**Green Dot**	**5.3**	**1169**
	8.1	1126		4.9	1105		4.7	1038
231	**5.8**	**1229**	**Unique**	**5.7**	**1191**	**700-X**	**5.2**	**1148**
	5.2	1108		5.1	1068		4.7	1065
HS-6	**7.3**	**1221**	**HP-38**	**5.4**	**1184**	**Red Dot**	**4.5**	**1111**
	6.6	1109		4.8	1061		4.0	981

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

38 S&W

The 38 S&W (not to be confused with the 38 Special) is an old revolver cartridge dating to 1877 when Smith & Wesson introduced it in a hinged frame or "break-top" revolver. It became popular for small, concealable handguns, and was adopted as a British service re-volver cartridge before World War II.

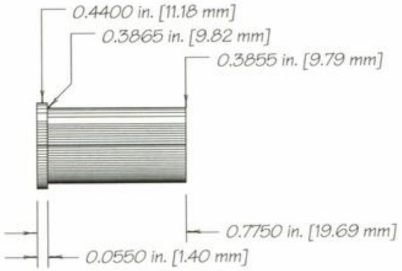
Much of the 38 S&W's appeal was that it was so well-suited for compact revolvers. Not until small-frame 38 Specials like the Colt Detective Special and the S&W's Chief Special revolvers became readily available did the 38 S&W's popularity start to slip. Even with 38 Special snub-nose revolvers around, several firms continued to make inexpensive revolvers chambered for the 38 S&W until just recently.

The 38 S&W is also known by other names, including the 38 Colt New Police, the 38 Super Police and the 38/200. The last two cartridges were loaded with 200 grain lead bullets for additional "stopping power". The last British military version was known as the "380 Revolver Mk II-Z"; it featured a 178 grain FMJ bullet at about 600 fps.

The quality of revolvers chambered for this cartridge varies from excellent to dismal. All hinged-frame revolvers produced prior to WWII should be considered unsuitable for shooting. Often their latching mechanisms are frail and become ineffective when worn. Notable exceptions are the British Enfield and Webley revolvers, which feature a very robust latch. The loads shown are intended for use only in modern, solid-frame revolvers or Enfields and Webleys known to be in top condition.

The nominal bullet diameter for the 38 S&W cartridge is .360", so the bullets listed are actually undersized for this cartridge. However, in revolvers with deep rifling, accuracy is usually fairly good. The case is also larger in diameter than the 38 Special, so Special cases should not be cut off and reloaded. They will bulge and often split on the first shot.

The SAAMI pressure limit for the 38 S&W cartridge is 13,000 cup. The following loads were not pressure tested, but were quite mild in the test revolver.


0.4400 in. [11.18 mm]
0.3865 in. [9.82 mm]
0.3855 in. [9.79 mm]
0.7750 in. [19.69 mm]
0.0550 in. [1.40 mm]

Max. Case Length: 0.775"
Trim-to Length: 0.765"
Max. Cart. Length: 1.240"
RCBS Shellholder: #6
Barrel Length: 4"
Twist: 1-18.75"

Test Firearm: Smith & Wesson Model 33
Case: W-W
Primers: CCI 500

.357" Dia. **110 Grain** Sect. Density .123	**38** **JHP**					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.075"					
Speer Part No.	4007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Herco	**5.3**	**1060**	**Bullseye**	**3.2**	**935**	**SR 7625**	**3.8**	**909**
	5.0	1013		3.0	894		3.5	826
Unique	**5.1**	**1001**	**Red Dot**	**3.5**	**929**	**231**	**3.2**	**797**
	4.8	938		3.2	852		2.9	725

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.357" Dia. 125 Grain Sect. Density .140	38 JSP	38 GD-HP	38 JHP	38 TMJ		
Ballistic Coefficient	0.140	0.140	0.135	0.146		
C.O.L. Tested At	1.075"	1.080"	1.075"	1.080"		
Speer Part No.	4011	4012	4013	4015		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Herco	**5.0**	**986**	**Red Dot**	**3.3**	**846**	**Bullseye**	**3.0**	**789**
	4.7	914		3.0	773		2.8	742
Unique	**4.8**	**972**	**SR 7625**	**3.5**	**826**	**231**	**3.0**	**662**
	4.5	920		3.2	748		DNR	—

Note: In this cartridge, the Bevel Base Wadcutter bullet is seated to and crimped in the top lubrication groove, not the regular crimping groove.

.358" Dia. 148 Grain Sect. Density .166	38 BB-WC					
Ballistic Coefficient	0.052					
C.O.L. Tested At	1.065"					
Speer Part No.	4605					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Red Dot	**3.0**	**797**	**Unique**	**3.4**	**747**	**Herco**	**3.5**	**746**
	2.7	698		3.1	673		3.2	689
SR 7625	**3.1**	**760**	**Bullseye**	**2.7**	**748**	**231**	**2.8**	**688**
	2.8	692		2.5	701		2.5	609

.358" Dia. 158 Grain Sect. Density .176	38 L-SWC	38 L-HP	38 L-RN			
Ballistic Coefficient	0.123	0.121	0.170			
C.O.L. Tested At	1.065"	1.065"	1.065"			
Speer Part No.	4623	4627	4647			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Red Dot	**2.7**	**765**	**Herco**	**3.2**	**702**	**Bullseye**	**2.4**	**693**
	2.4	667		2.9	630		2.2	629
SR 7625	**2.9**	**752**	**Unique**	**3.1**	**694**	**231**	**2.6**	**671**
	2.6	683		2.8	619		2.3	593

Notes: Bold print denotes maximum loads. They should be used with caution.
DNR = Do not reduce.

[At Standard Pressures] 38 SPECIAL

In terms of revolvers sold and number of cartridges reloaded, the 38 Special is probably at the top of the stack. This is one of the most widely accepted cartridges ever. 38 Special revolvers are manufactured and used around the world.

Smith & Wesson introduced the 38 Special in 1902 as a ballistic improvement over the 38 Long Colt cartridge. The new cartridge was somewhat more powerful but much of its acceptance was due to its excellent accuracy compared with other medium-caliber revolver cartridges of the period. Originally loaded with black powder, the cartridge was quickly converted to smokeless as the new propellants became available.

The original cartridge used a 158 grain lead round nose bullet, a design that remains with us today. Wadcutter bullets were also loaded to cut clean, full-caliber holes in paper targets. Other than handful of specialty loads for law enforcement, these two bullets were just about the only choices in factory ammunition until the late 1960's when expanding jacketed bullets were introduced.

During the 1930's demand for better 38 Special performance led to the introduction of heavy-frame revolvers designed to handle the 158 grain bullets at higher velocities—up to 1000 feet/sec. Thus, two pressure levels existed in the industry for years. The heavy loads were often headstamped "HS", "HV" or "38/44". Obviously, having ammo available with two pressures levels presented a problem. Lighter revolvers could eventually loosen if they fired too many high-pressure cartridges. There was little uniformity in case markings, meaning you couldn't tell a high-pressure load by looking at the cartridge.

Confusion over load identification was finally eliminated in 1974, when SAAMI instituted the +P (plus pressure) designator on cartridge headstamps. Cartridges bearing the +P mark were loaded to the higher pressure limit. Since all U.S. ammo makers agreed to use this system, the shooter could simply look at a factory cartridge and tell the pressure level even without the original box.

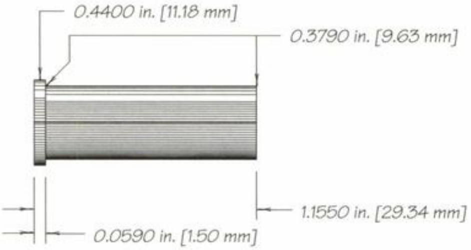
Because there are differences in the reloading of 38 Special and 38 Special +P cartridges, we have listed data for this cartridge in separate sections. The section on +P loads immediately follows this one.

Reloaders must remember that the 38 Special started life as a black powder cartridge. Thus, the case is much bigger than necessary for many modern propellants. A maximum-pressure charge of some powders takes up very little room in the case. Air space is high, especially when loading standard (not +P) loads.

When loading standard pressure 38 Specials, lead bullets are usually best. They are easily propelled through the barrel by light powder charges. Jacketed bullets create more resistance than lead bullets and can actually stick in the bore with light charges. This condition is aggravated in revolvers with large chamber throats or excessive barrel/cylinder gaps. To help avoid these problems, we are showing jacketed bullet data for only the 110 and 125 grain bullets. Heavier bullets may not attain sufficient velocity to reliably overcome friction. Note that these loads are marked "DNR", meaning "do not reduce". Reductions of loads below the levels shown can result in a bullet-in-bore condition in revolvers with excessive barrel/cylinder gaps. THESE JACKETED BULLET LOADS MUST NOT BE USED IN RIFLES.

Wadcutters are popular for target shooting and are also very effective small-game bullets if the ranges do not exceed 50 yards. At greater distances, the 158 semi-wadcutters will give better accuracy due to their superior stability. The 148 bevel-base wadcutter should be lightly crimped in the crimp groove provided. The hollow-base wadcutter (HBWC) is designed to be seated flush with the case mouth which is then lightly crimped into the leading edge of the bullet. Loads for the HBWC are not at maximum pressure, but are held to velocity levels which give good accuracy in semi-auto target pistols. To avoid bullet base deformation, do not exceed these loads when using HBWC bullets.

The SAAMI pressure limit for the 38 Special is 17,000 psi.



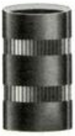
Max. Case Length: 1.155"
Trim-to Length: 1.145"
Max. Cart. Length: 1.550"
RCBS Shellholder: #6
Barrel Length: 6"
Twist: 1-18.75"

Test Firearm: Smith & Wesson Model 14
Case: Speer
Primers: CCI 500, 550

.358" Dia. **148 Grain** Sect. Density .166	**38** **BB-WC**				
Ballistic Coefficient	0.052				
C.O.L. Tested At	1.295"				
Speer Part No.	4605				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**5.1**	**981**	Bullseye	**4.5**	**933**	231	**4.7**	**926**
	4.5	868		3.9	813		4.1	811
Red Dot	**4.3**	**964**	SR 7625	**4.3**	**931**	700-X	**4.0**	**924**
	3.7	825		3.7	813		3.6	836

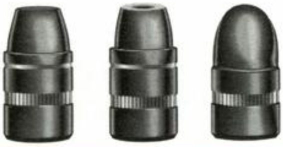
Notes: Bold print denotes maximum loads. They should be used with caution.



Note: Seat bullets flush with case mouth.

.358" Dia. **148 Grain** Sect. Density .166	**38** **HB-WC**					
Ballistic Coefficient	0.050					
C.O.L. Tested At	1.115"					
Speer Part No.	4617					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Red Dot	**3.0**	**806**	**HP-38**	**3.2**	**801**	**700-X**	**2.9**	**791**
	2.7	754		2.9	752		2.6	739
231	**3.3**	**804**	**Bullseye**	**3.1**	**799**	**AA #2**	**3.1**	**789**
	3.0	749		2.8	741		2.7	690



.358" Dia. **158 Grain** Sect. Density .175	**38** **L-SWC**	**38** **L-HP**	**38** **L-RN**			
Ballistic Coefficient	0.123	0.121	0.170			
C.O.L. Tested At	1.440"	1.455"	1.510"			
Speer Part No.	4623	4627	4647			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-6*	**6.1**	**944**	**H. Universal**	**4.7**	**923**	**HP-38**	**4.3**	**886**
	5.6	871		4.3	847		3.9	806
SR 4756	**4.8**	**943**	**Unique**	**4.7**	**913**	**231**	**4.4**	**878**
	4.4	862		4.3	853		4.0	792
Herco	**5.1**	**936**	**Bullseye**	**4.2**	**888**	**SR 7625**	**4.1**	**856**
	4.6	842		3.8	801		3.7	779

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.357" Dia. **110 Grain** Sect. Density .123	**38** **JHP**					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.430"					
Speer Part No.	4007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**8.2**	**1198**	**AA #5**	**7.8**	**1116**	**Bullseye**	**4.7**	**1022**
	DNR	—		DNR	—		DNR	—
WAP	**6.9**	**1152**	**Unique**	**5.9**	**1097**	**231**	**5.6**	**1005**
	DNR	—		DNR	—		DNR	—
H. Universal	**6.0**	**1134**	**Viht. 3N37**	**6.9**	**1061**			
	DNR	—		DNR	—			

.357" Dia. **125 Grain** Sect. Density .140	**38** **JSP**	**38** **GD-HP**	**38** **JHP**	**38** **TMJ**		
Ballistic Coefficient	0.140	0.140	0.135	0.146		
C.O.L. Tested At	1.435"	1.470"	1.435"	1.435"		
Speer Part No.	4011	4012	4013	4015		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #5	**7.8**	**1053**	**WAP**	**6.5**	**982**	**231**	**5.6**	**944**
	DNR	—		DNR	—		DNR	—
Viht. 3N37	**6.8**	**1037**	**Unique**	**5.7**	**980**	**Bullseye**	**4.5**	**914**
	DNR	—		DNR	—		DNR	—
AA #2	**5.4**	**994**	**H. Universal**	**5.6**	**976**	**700-X**	**4.6**	**905**
	DNR	—		DNR	—		DNR	—

Notes: Bold print denotes maximum loads. They should be used with caution.
DNR = Do not reduce.

[See previous section for 38 Special at standard pressures.]

38 SPECIAL +P

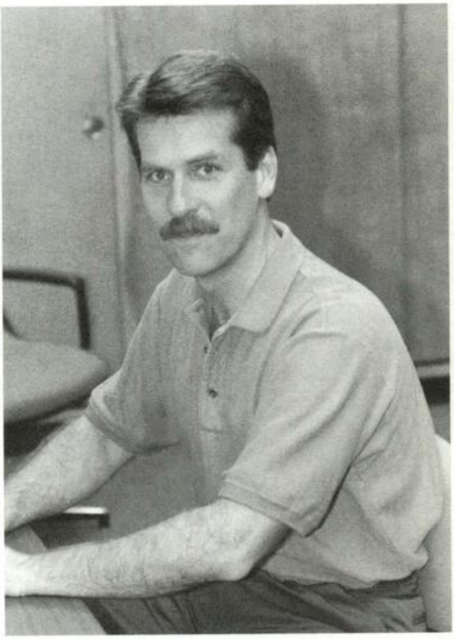
In the 1930's, the performance of the standard 38 Special was enhanced by the addition of loads at higher operating pressures. These were sometimes headstamped "38 HV", "38 HS" or "38/44" to indicate the higher pressure. Originally these loads were intended for firing only in heavy revolvers built on 44 Special frames.

In order to have a consistent system for identifying higher-pressure ammo, the industry adopted the +P headstamp in 1974. The three cartridges to which this identifier was first applied were the 38 Super Auto, the 257 Roberts and the 38 Special.

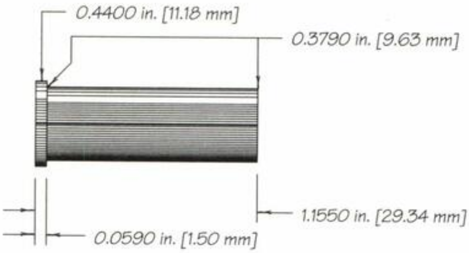
The current SAAMI pressure limit for 38 Special +P ammunition is 1500 psi higher than for the standard 38 Special. This allows a bit more flexibility for the handloader, because jacketed bullets can be driven at higher velocity. When loading jacketed bullets, you must not use loads lighter than the starting loads shown.

Even at +P velocities, best expansion is obtained with Speer's 110 and 125 grain hollow points. Heavier bullets give less expansion, but offer deeper penetration. Powders having a moderate burning rate give the best performance in the 38 +P. Jacketed bullets heavier than 146 grains yielded very low velocities under the new SAAMI pressure standards and we no longer recommend them in the 38 Special.

Some revolvers are not rated for 38 Special +P ammunition. Contact your firearm's manufacturer and follow their recommendation on the use of this ammunition. Firearms not approved for +P ammunition will show accelerated wear if subjected to continuous firing with +P ammo.



Kerry Swett, RCBS Advertising Coordinator



Max. Case Length: 1.155"
Trim-to Length: 1.145"
Max. Cart. Length: 1.550"
RCBS Shellholder: #6
Barrel Length: 6"
Twist: 1-18.75"

Test Firearm: Smith & Wesson Model 14
Case: Speer
Primers: CCI 500, 550

.357" Dia. **110 Grain** Sect. Density .123	**38** **JHP**					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.430"					
Speer Part No.	4007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**8.5**	**1237**	**Viht. 3N37**	**7.3**	**1185**	**Bullseye**	**5.1**	**1111**
	8.2	1198		6.9	1061		4.7	1022
WAP	**7.3**	**1194**	**Unique**	**6.2**	**1165**	**231**	**5.9**	**1108**
	6.9	1152		5.9	1097		5.6	1005
H. Universal	**6.3**	**1192**	**AA #5**	**8.2**	**1137**			
	6.0	1134		7.8	1116			

.357" Dia. **125 Grain** Sect. Density .140	**38** **JSP**	**38** **GD-HP**	**38** **JHP**	**38** **TMJ**		
Ballistic Coefficient	0.140	0.140	0.135	0.146		
C.O.L. Tested At	1.435"	1.440"	1.435"	1.435"		
Speer Part No.	4011	4012	4013	4015		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. 3N37	**7.2**	**1098**	**WAP**	**6.9**	**1081**	**231**	**5.9**	**1019**
	6.9	1037		6.5	982		5.6	944
AA #5	**8.1**	**1089**	**H. Universal**	**5.9**	**1058**	**AA #2**	**5.7**	**1014**
	7.8	1053		5.6	976		5.4	994
Unique	**6.0**	**1082**	**Bullseye**	**4.8**	**1021**	**700-X**	**4.9**	**1013**
	5.7	980		4.5	914		4.6	905

Notes: Bold print denotes maximum loads. They should be used with caution.

.357" Dia. **140 Grain** Sect. Density .157	**38** **JHP**					
Ballistic Coefficient	0.152					
C.O.L. Tested At	1.435"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #7	**9.2**	**1078**	**Viht. N350**	**6.2**	**982**	**Unique**	**5.3**	**960**
	8.6	1025		5.9	924		5.0	902
Blue Dot	**7.4**	**1053**	**WSF**	**5.5**	**974**	**231**	**5.1**	**931**
	7.1	1024		5.3	930		4.8	870
AA #5	**7.1**	**1002**	**H. Universal**	**5.3**	**969**			
	6.8	955		5.0	935			

.357" Dia. **146 Grain** Sect. Density .163	**38** **JHP-SWC**					
Ballistic Coefficient	0.159					
C.O.L. Tested At	1.370"					
Speer Part No.	4205					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #7	**8.2**	**1004**	**Unique**	**5.1**	**957**	**2400**	**8.0**	**859**
	7.8	937		4.8	905		7.6	786
Blue Dot	**7.8**	**1000**	**H. Universal**	**5.0**	**940**	**231**	**4.5**	**845**
	6.7	971		4.6	894		4.3	791

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

357 MAGNUM

The 357 Magnum was introduced in 1935 as the result of Smith & Wesson's extensive research with high-performance 38 Special loads. Much of this interest was stimulated by Elmer Keith and Phil Sharpe, who found that heavy charges of quick-burning rifle powders in a 38 case could achieve significant increases in velocity and game performance.

Major D.B Wesson wisely noted that a 38 Special cartridge loaded to very high pressures would be a severe hazard if accidentally fired in one of the lighter frame 38 Special revolvers. To avoid this, he designed a new cartridge which was physically identical to the 38 Special except for case length. The extra .135" of case prevented the new cartridge from chambering in 38 Special revolvers.

Thus was born the first "Magnum" handgun cartridge. Factory ammunition was first loaded by Winchester and others soon followed. The original Smith & Wesson 357 revolver was a high-grade model made with special steel and fitting to handle the new cartridge. Within a year, Colt chambered their massive New Service and Shooting Master revolvers for the 357 Magnum.

The popularity of the 357 didn't take off until after the Korean war when Smith & Wesson and Colt both introduced lighter, less expensive revolvers. An added advantage of owning a 357 Magnum revolver is that 38 Special ammunition may be used for practice.

Factory 357 Magnum ammunition was loaded with only 158 grain lead bullets until the late 1960's when jacketed bullets appeared. The soft lead bullets always caused severe barrel leading, so jacketed projectiles were a welcome improvement.

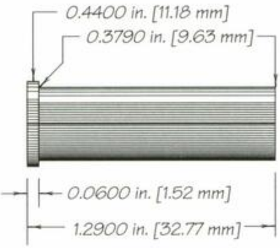
Today's handloader has an excellent selection of bullets. Speer's 110 grain JHP at high velocity is an explosive varmint bullet. The 125 grain Gold Dot HP offers excellent expansion and better penetration. The 140 grain JHP is excellent for defense and hunting. It has less recoil than the 158 grain bullets, yet still offers adequate penetration. For deer hunting, the 158 grain Gold Dot HP and the 158 JSP are both good choices.

Some states have minimum muzzle energy requirements for handgun hunting which may eliminate the 357 Magnum from consideration. Check with your local game department for applicable regulations.

The 158 grain lead semi-wadcutters, both in solid and hollow point form, make good practice and target loads. To avoid leading, we recommend limiting velocities to around 1000 feet/sec.

Slow-burning pistol powders require a heavy roll crimp and often a magnum primer to insure proper ignition. Use magnum primers whenever they are specified in the data. We found the new VihtaVuori N110 to be an excellent 357 Magnum propellant.

The SAAMI maximum average pressure for the 357 Magnum is 35,000 psi. These loads do not exceed that level.



Max. Case Length: 1.290"
Trim-to Length: 1.280"
Max. Cart. Length: 1.590"
RCBS Shellholder: #6
Barrel Length: 6"
Twist: 1-18.75"

Test Firearm: Smith & Wesson Model 19
Case: Speer
Primers: CCI 500, 550

.358" Dia. **148 Grain** Sect. Density .166	**38** **HB-WC**					
Ballistic Coefficient	0.050					
C.O.L. Tested At	1.290"					
Speer Part No.	4617					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #2	**3.6**	**822**	**700-X**	**3.2**	**815**	**231**	**3.8**	**811**
	2.6	690		2.9	745		3.4	747
HP-38	**3.9**	**820**	**Red Dot**	**3.4**	**812**	**Bullseye**	**3.3**	**806**
	3.5	758		3.0	750		3.0	733

Notes: Bold print denotes maximum loads. They are not at maximum pressure, but should not be exceeded to avoid damage to bullet bases.

.358" Dia.
158 Grain

Sect. Density .176

	38 SWC					
Ballistic Coefficient	0.123					
C.O.L. Tested At	1.570"					
Speer Part No.	4623					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**6.0**	**1034**	**700-X**	**5.0**	**1002**	**Bullseye**	**4.8**	**939**
	5.5	970		4.5	904		4.3	848
SR 7625	**5.3**	**1021**	**231**	**5.4**	**989**	**HP-38**	**5.0**	**932**
	4.8	926		4.9	897		4.5	839

Notes: Bold print denotes maximum loads. The above loads are not at maximum pressure, but were held to 1000 fps. to reduce barrel leading.

.357" Dia.
110 Grain

Sect. Density .123

	38 JHP					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.575"					
Speer Part No.	4007					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**21.0C**	**1693**	**Unique**	**9.7**	**1447**	**2400***	**15.0**	**1362**
	19.0	1557		8.5	1284		13.0	1227
Blue Dot	**16.0**	**1680**	**Viht. 3N37**	**10.8**	**1433**	**HS-7**	**14.4**	**1341**
	14.0	1548		9.7	1305		12.5	1182
WAP	**11.0**	**1480**	**Bullseye**	**8.7**	**1403**	**AA #5**	**12.0**	**1330**
	10.0	1362		7.8	1246		10.8	1246

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.357" Dia. 125 Grain Sect. Density .140	38 JSP	38 GD-HP	38 JHP	38 TMJ		
Ballistic Coefficient	0.140	0.140	0.135	0.146		
C.O.L. Tested At	1.575"	1.580"	1.575"	1.575"		
Speer Part No.	4011	4012	4013	4015		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**18.8**	**1507**	AA #9	**14.6**	**1238**	HS-7*	**13.3**	**1169**
	16.8	1383		12.6	1119		11.8	1052
Unique	**9.6**	**1343**	Viht. N350	**10.0**	**1226**	AA #7*	**13.5**	**1134**
	8.6	1259		9.0	1097		12.0	1045
296*	**20.3**	**1336**	WAP	**10.0**	**1181**	HS-6*	**11.3**	**1124**
	18.3	1188		9.0	988		10.0	1009
Blue Dot	**13.0**	**1333**	Viht. 3N37	**10.2**	**1180**	Viht. N340	**8.8**	**1124**
	11.5	1252		9.0	1035		7.9	969
H110*	**20.0**	**1282**	2400*	**14.3**	**1175**			
	18.0	1154		12.5	977			

Note: The .357" 146 gr. JHP-SWC may be used with these loads by reducing the maximum charges by one grain.

.357" Dia. 140 Grain Sect. Density .157	38 JHP					
Ballistic Coefficient	0.152					
C.O.L. Tested At	1.590"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**17.0C**	**1397**	WAP	**9.0**	**1203**	2400*	**13.0**	**1179**
	15.0	1208		8.1	1092		11.7	1077
Blue Dot	**11.5**	**1324**	Viht. N350	**9.1**	**1195**	HS-7*	**11.9**	**1179**
	10.3	1234		8.1	1078		10.7	1041
IMR 4227	**19.2C**	**1298**	Viht. 3N37	**9.1**	**1195**	Bullseye	**7.0**	**1160**
	17.2	1153		8.1	1079		6.3	1065
H110*	**18.0**	**1288**	Unique	**8.0**	**1185**	HS-6*	**9.8**	**1142**
	16.0	1117		7.2	1086		8.8	1005
296*	**18.0**	**1235**	AA #5	**10.2**	**1181**	231*	**7.1**	**1105**
	16.0	1085		9.1	1111		6.3	978

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

Note: The .357" 160 gr. JSP-SWC may be used with these loads by reducing the maximum charges by one grain.

.357" Dia. **158 Grain** Sect. Density .177	38 TMJ	38 JHP	38 GD-HP	38 JSP		
Ballistic Coefficient	0.173	0.158	0.168	0.150		
C.O.L. Tested At	1.570"	1.570"	1.575"	1.570"		
Speer Part No.	4207	4211	4215	4217		

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**15.0**	**1253**	**AA #7**	**11.7**	**1140**	**Viht. N340**	**8.6**	**1072**
	13.5	1102		10.5	1015		7.7	958
H110*	**15.5**	**1217**	**AA #9**	**13.7**	**1136**	**HS-7***	**11.0**	**1041**
	13.9	1151		12.3	1052		9.9	895
Blue Dot	**10.2**	**1188**	**IMR 4227**	**17.0**	**1126**	**Unique**	**7.7**	**1040**
	9.0	1049		15.0	1003		6.9	978
296*	**14.7**	**1185**	**2400***	**12.5**	**1089**	**H. Universal**	**7.3**	**1015**
	13.2	1089		11.2	957		6.5	904
AA #5	**10.0**	**1152**	**WAP**	**8.6**	**1084**	**231**	**6.8**	**986**
	9.0	1032		7.7	944		6.0	877

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

TO DO IT
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357 MAGNUM (SILHOUETTE LOADS)

The popularity of metallic silhouette competition caused many 357 Magnum owners to try their handguns on steel targets. Toppling heavy steel plates at long range with a 357 requires tough, heavy bullets. The Speer 180 and 200 grain TMJ Silhouette Match bullets fill the bill.

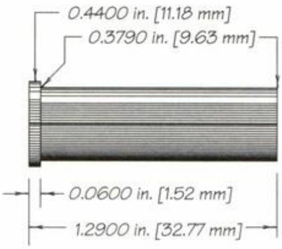
These two bullets were not originally designed for revolver use. They were developed for single-shot target pistols such as the Thompson/Center Contender, which aren't too fussy about cartridge overall length (COL). Normal seating of these bullets produces a COL of 1.680", well over the 357 Magnum's maximum cartridge length of 1.590". Contender barrels have generous throats and this length poses no problems in them. Revolvers are another story.

First of all, the following loads should only be used in heavy-frame 357 Magnum revolvers. To use these specialty bullets in a revolver, it must have a total cylinder length of at least 1.625" (not counting rim recesses, if present). In addition, special loading techniques must be observed. Cases must be trimmed to the SAAMI minimum of 1.275" and bullets seated so that the case mouth covers almost all the crimping groove. A very firm crimp must be applied to the bullet to prevent bullet jump during recoil. This extra attention to detail maximizes the clearance between the bullet tip and the front face of the cylinder.

If you are uncertain of your cylinder length, make a dummy round (no powder or primer) using the above technique and try it in your cylinder. For proper, safe function the bullet tip must be below the face of the cylinder.

Not all makes and models of 357 Magnum revolvers have cylinders which are long enough to use the above loading technique. In earlier editions of the Speer Manual, our recommendation for such revolvers involved seating the 180 and 200 grain bullets deeper so that the case could be crimped over the bullet's shoulder just ahead on the cannelure. This required a significant reduction in powder charges resulting in relatively low velocities. In addition, certain makes of cases exhibited sidewall bulges where the bullet heel contacted the internal taper of the case, causing difficult chambering. Thus we no longer recommend the deep-seating technique.

If your revolver has a short cylinder, we recommend choosing the 158 grain .357" TMJ bullet. It is every bit as accurate as the 180 and 200 grain silhouette bullets and will fit short cylinders with normal loading techniques. The velocity increase compared to the heavier bullets will usually offset the difference in weight.



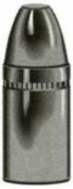
Max. Case Length: 1.290"	**Test Firearm:** Thompson/Center Contender
Trim-to Length: 1.280"	**Case:** Speer
Max. Cart. Length: See Text	**Primers:** CCI 500, 550
RCBS Shellholder: #6	
Barrel Length: 10"	
Twist: 1-14"	

Note: The loads in this section were developed on copper crusher pressure equipment to the SAAMI crusher limit of 45,000 CUP. They are recommended only for single-shot pistols and heavy-frame revolvers. See the text in this section for special loading information.

.357" Dia. **180 Grain** Sect. Density .202	**38 TMJ-Sil.**					
Ballistic Coefficient	0.230					
C.O.L. Tested At	1.690"					
Speer Part No.	4229					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**15.9**	**1573**	**AA #9**	**14.4**	**1503**	**2400***	**13.5**	**1416**
	14.3	1430		13.0	1388		12.1	1291
H110*	**16.1**	**1528**	**IMR 4227***	**15.7**	**1429**	**Blue Dot**	**11.2**	**1371**
	14.5	1396		14.1	1274		10.1	1245

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.357" Dia. **200 Grain** Sect. Density .224	**38** **TMJ-Sil.**					
Ballistic Coefficient	0.236					
C.O.L. Tested At	1.690"					
Speer Part No.	4231					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**14.5**	**1392**	**AA #9**	**12.7**	**1369**	**IMR 4227***	**13.2**	**1222**
	13.5	1317		11.7	1262		12.2	1088
296*	**14.0**	**1370**	**2400***	**12.0**	**1336**			
	13.0	1286		11.0	1243			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
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357 MAXIMUM

The 357 Maximum was introduced jointly by Remington and Sturm-Ruger as a flat-shooting silhouette cartridge/handgun combination. Announced in 1983, the Maximum was offered in a single loading a 158 grain JHP bullet, and only in a "stretched" version of the Ruger Blackhawk revolver. Within a short time, Dan Wesson developed a revolver for the new cartridge and Thompson/Center offered 357 Maximum barrels for the Contender single-shot pistol.

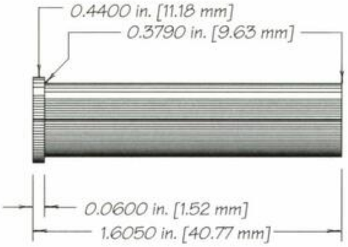
The Maximum is simply the 357 Magnum case extended by .315" to provide greater powder capacity. The pressure limit was increased 3000 cup over the 357 Magnum. The factory 158 grain hollow point bullets were thought by some to be too light for game. Several ammo makers later introduced 180 grain factory loads to overcome this objection. Of course, handloaders had already discovered that the cartridge could be loaded with heavier bullets.

As a hunting cartridge, the Maximum offers flat trajectory and good retained energy. Hits at long range are surprisingly easy with a scope-sighted handgun. A few custom carbines have been made for this cartridge and their owners seem very satisfied with them

Because of the cartridge's high velocity, any hollow point bullets lighter than 180 grains should be considered varmint bullets. Best bullet choices for medium-sized deer are the .357" 158 grain soft point and, for single shot pistols, the .358" 180 grain FNSP rifle bullet. The latter bullet was designed for low velocity rifles like the 35 Remington but also performs well in the Maximum.

The 180 and 200 grain TMJ are intended for silhouette competition. They should not be used on game animals. To make seating the 200 grain bullet easier, a longer expander plug may be required to avoid collapsing the case. We recommend seating and crimping in separate operations when loading this cartridge.

Because of the high pressure levels produced by the 357 Maximum, we recommend the use of small rifle primers in this cartridge. These loads do not exceed the SAAMI pressure limit of 48,000 cup.



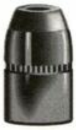
Max. Case Length: 1.605"
Trim-to Length: 1.595"
Max. Cart. Length: 1.990"
RCBS Shellholder: #6
Barrel Length: 14"
Twist: 1-14"

Test Firearm: T/C Contender
Case: R-P
Primers: CCI 400

.357" Dia. **125 Grain** Sect. Density .140	**38** **JSP**	**38** **JHP**	**38** **TMJ**			
Ballistic Coefficient	0.140	0.135	0.146			
C.O.L. Tested At	1.885"	1.885"	1.885"			
Speer Part No.	4011	4013	4015			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**29.0C**	**2432**	**Viht. N110**	**22.5**	**2224**	**IMR 4227**	**26.0**	**2148**
	27.0	2205		20.5	2066		24.0	2031
296	**28.0C**	**2381**	**2400**	**21.5**	**2188**			
	26.0	2223		19.5	2054			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

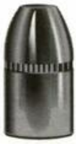


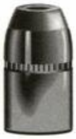
.357" Dia. 140 Grain

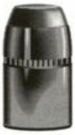
Sect. Density .157

	38 JHP					
Ballistic Coefficient	0.152					
C.O.L. Tested At	1.890"					
Speer Part No.	4203					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**27.0C**	**2283**	**Viht. N110**	**21.0**	**2029**	**2400**	**20.0**	**1981**
	25.0	2095		19.0	1888		18.0	1880
296	**26.5C**	**2261**	**AA 1680**	**28.0C**	**1996**	**IMR 4227**	**24.0C**	**1977**
	24.5	2093		26.0	1822		22.0	1824







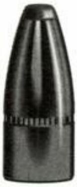
.357" Dia. 158 Grain

Sect. Density .177

	38 TMJ	38 JHP	38 JSP			
Ballistic Coefficient	0.173	0.158	0.150			
C.O.L. Tested At	1.875"	1.875"	1.875"			
Speer Part No.	4207	4211	4217			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**24.0**	**2058**	**AA 1680**	**27.0C**	**1938**	**IMR 4227**	**22.5C**	**1866**
	22.0	1896		25.0	1796		20.5	1735
296	**23.5**	**2046**	**2400**	**18.5**	**1895**	**Viht. N120**	**24.0C**	**1857**
	21.5	1883		16.5	1747		22.0	1670

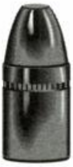
Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.358" Dia.
180 Grain
Sect. Density .202

	35 Flat-SP					
Ballistic Coefficient	0.245					
C.O.L. Tested At	2.145"					
Speer Part No.	2435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**27.0C**	**1884**	**H110**	**22.5**	**1820**	**Viht. N120**	**23.0C**	**1678**
	25.0	1719		20.5	1662		21.0	1477
296	**23.0**	**1881**	**2400**	**18.0**	**1710**	**IMR 4227**	**21.5**	**1677**
	21.0	1708		16.0	1575		19.5	1564

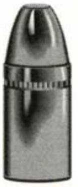


.357" Dia.
180 Grain
Sect. Density .114

	38 TMJ-Sil.					
Ballistic Coefficient	0.230					
C.O.L. Tested At	1.990"					
Speer Part No.	4229					

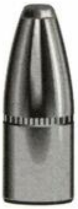
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA 1680	**26.0C**	**1849**	**H110**	**20.5**	**1699**	**IMR 4227**	**20.0**	**1577**
	24.0	1685		18.5	1546		18.0	1457
296	**20.5**	**1716**	**2400**	**16.5**	**1585**	**Viht. N120**	**21.0C**	**1540**
	18.5	1572		14.5	1437		19.0	1339

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load



.357" Dia. 200 Grain Sect. Density .224	38 TMJ-Sil.					
Ballistic Coefficient	0.236					
C.O.L. Tested At	1.990"					
Speer Part No.	4231					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**19.0**	**1613**	**Viht. N120**	**20.0**	**1469**	**AA #9**	**15.0**	**1393**
	17.0	1416		18.0	1305		13.0	1218
AA 1680	**22.0C**	**1551**	**IMR 4227**	**18.0**	**1446**	**296**	**18.0**	**1390**
	20.0	1457		16.0	1309		16.0	1213
2400	**15.5**	**1503**	**Viht. N110**	**16.0**	**1418**			
	13.5	1293		14.0	1292			



.358" Dia. 220 Grain Sect. Density .245	35 Flat-SP					
Ballistic Coefficient	0.316					
C.O.L. Tested At	2.145"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**18.5**	**1541**	**296**	**18.0**	**1500**	**IMR 4227**	**18.5**	**1438**
	16.5	1339		16.0	1314		16.5	1255
AA 1680	**22.0C**	**1509**	**Viht. N120**	**20.0C**	**1445**	**2400**	**15.0**	**1361**
	20.0	1342		18.0	1216		13.0	1194

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

35 REMINGTON (HANDGUN)

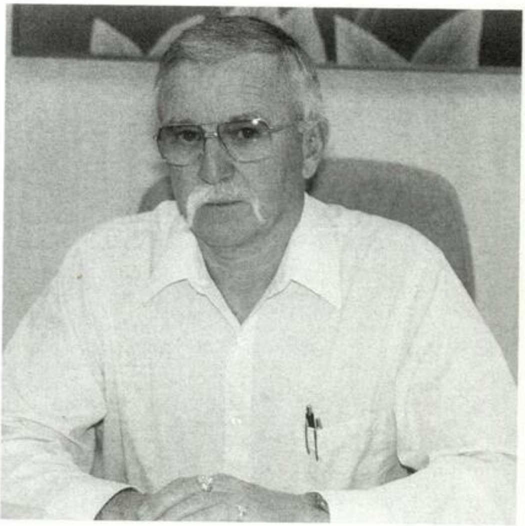
Silhouette shooters saw the need for a powerful 35 caliber pistol which did not require special case-forming. The solution was the venerable 35 Remington rifle cartridge. In a 14 inch barrel, the 35 Remington delivered an additional 200 feet/sec over the potent 357 Maximum, even though the older cartridge operates at much lower pressures. Thompson/Center and Remington now build 35 Remington single-shot pistols.

Because the 35 Remington in a Contender or XP-100 produces velocities quite close to those from a rifle, it also makes a good handgun hunting cartridge. Most people choose the 180 grain flat point for deer hunting because velocities are high enough to keep the trajectory flat.

Firing a new case in the Contender may result in an occasional misfire because some makes of brass have a minimum length shoulder or are a bit soft. The firing pin blow moves the shoulder slightly, cushioning the impact on the primer. This is a brass problem, not a gun problem.

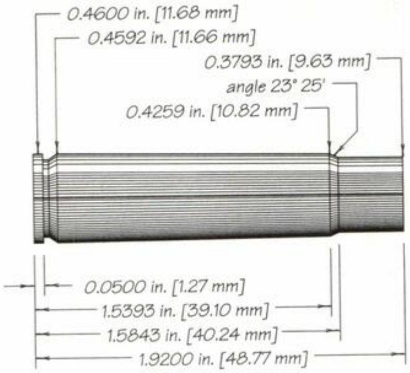
To avoid misfires on the first firing, you can use a .375" diameter tapered expander ball to neck up the case and then carefully resize only the neck in a 35 Remington sizer until your action will just close on the case. This positions an auxiliary shoulder at the maximum shoulder length for your chamber. Fire-forming with a near-maximum load completes the operation and the case should perform fine for subsequent firings as long as you neck size. Tapered expanders can be ordered from RCBS.

We recommend neck sizing this cartridge in the T/C to improve accuracy and extend case life. These loads are within the 35,000 cup pressure limit set by SAAMI for this cartridge.



Elbert Graham, CCI/Speer Southport Manager

35 REMINGTON (HANDGUN)


0.4600 in. [11.68 mm]
0.4592 in. [11.66 mm]
0.3793 in. [9.63 mm]
angle 23° 25'
0.4259 in. [10.82 mm]
0.0500 in. [1.27 mm]
1.5393 in. [39.10 mm]
1.5843 in. [40.24 mm]
1.9200 in. [48.77 mm]

Max. Case Length: 1.920"
Trim-to Length: 1.910"
Max. Cart. Length: 2.525"
RCBS Shellholder: #9
Barrel Length: 14"
Twist: 1-14"

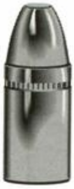
Test Firearm: Thompson/Center Contender
Case: W-W
Primers: CCI 200, 250

.357" Dia.
.358" Dia.

.357" Dia. **.358" Dia.** **180 Grain** Sect. Density .202	**35** **Flat-SP**	**38** **TMJ-Sil.**				
Ballistic Coefficient	0.245	0.230				
C.O.L. Tested At	2.470"	2.315"				
Speer Part No.	2435	4229				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**38.0**	**2023**	**BL-C(2)***	**35.0**	**1885**	**IMR 4198**	**30.0**	**1806**
	36.0	1871		33.0	1736		28.0	1683
H322	**38.0**	**1997**	**748***	**42.0**	**1879**	**H380***	**44.0**	**1782**
	36.0	1825		40.0	1714		42.0	1653
IMR 4895	**40.0**	**1896**	**IMR 3031**	**38.0**	**1837**	**Re7**	**30.0**	**1739**
	38.0	1786		36.0	1734		28.0	1565

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

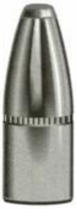


.357" Dia. 200 Grain

Sect. Density .224

	38 TMJ-Sil.					
Ballistic Coefficient	0.236					
C.O.L. Tested At	2.315"					
Speer Part No.	4231					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H335	**35.0**	**1791**	**IMR 4895**	**38.0**	**1770**	**IMR 3031**	**34.0**	**1659**
	33.0	1700		36.0	1629		32.0	1533
748*	**41.0**	**1781**	**IMR 4064**	**38.0**	**1757**	**H380***	**42.0**	**1608**
	39.0	1700		36.0	1650		40.0	1556
IMR 4198	**28.0**	**1773**	**IMR 4320**	**36.0**	**1668**	**Re7**	**28.0**	**1608**
	26.0	1560		34.0	1548		26.0	1519



.358" Dia. 220 Grain

Sect. Density .245

	35 Flat-SP					
Ballistic Coefficient	0.315					
C.O.L. Tested At	2.470"					
Speer Part No.	2439					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
IMR 4064	**36.0**	**1638**	**IMR 3031**	**33.5**	**1611**	**748***	**35.0**	**1550**
	34.0	1558		31.5	1495		33.0	1438
H414*	**40.0**	**1626**	**H335**	**32.0**	**1567**	**Re7**	**24.5**	**1421**
	38.0	1550		30.0	1429		22.5	1243
IMR 4895	**35.5**	**1620**	**BL-C(2)***	**35.0**	**1561**			
	33.5	1539		33.0	1460			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

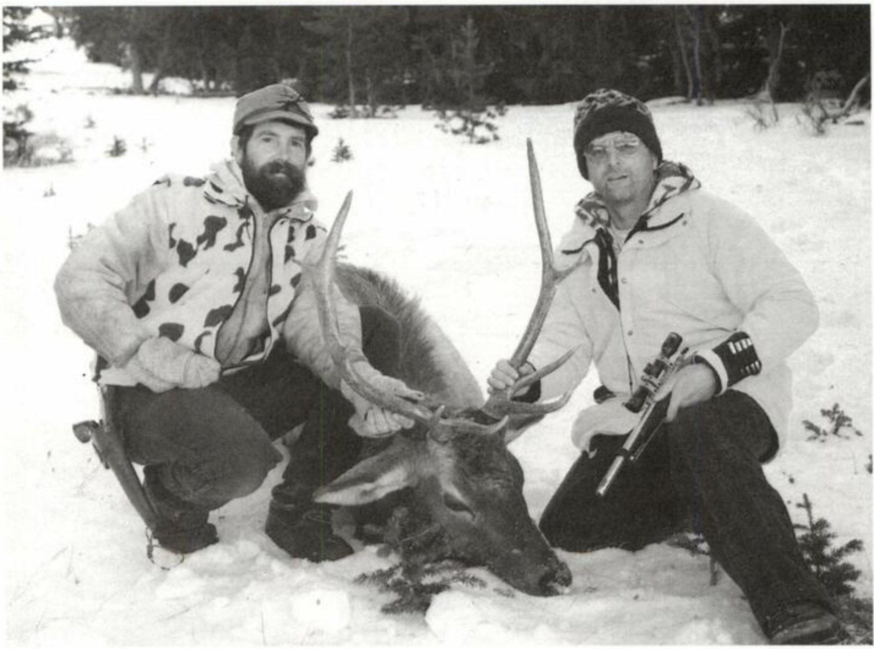
375 WINCHESTER (HANDGUN)

This is yet another rifle cartridge which has found a happy home in the Thompson/Center Contender single-shot pistol. The 375 is one of T/C's newer introductions and is catching on fast with handgun hunters.

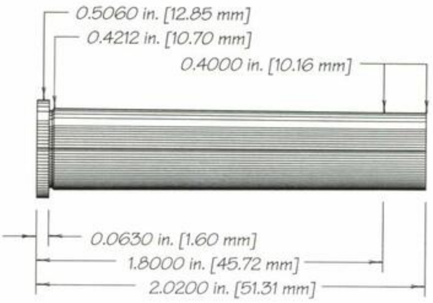
Speer makes only one bullet suitable for the 375 Winchester—the 235 grain semi-spitzer. Because it is designed to tolerate 2900 feet/sec in a 375 H&H Magnum, expansion at handgun velocities is modest but penetration is excellent. Velocities in the 14-inch test pistol approached 1900 feet/sec with Reloder 7. Heavier 375 bullets would yield very low velocities and therefore cannot be recommended.

Because this is a rimmed, straight-taper case, reloading is easily accomplished. We used a cartridge overall length of 2.600", slightly over the 2.560" maximum cartridge length specified for lever-action rifles.

These loads are somewhat below the industry maximum pressure of 52,000 cup but are compressed charges and should not be exceeded.



Dr. George Dvorchak (r), and outfitter Dave Warwood. George took this bull elk at 250 yards with a 375 JDJ. (270 gr. boat tail) *photo by—Michael J. Kisan*


0.5060 in. [12.85 mm]
0.4212 in. [10.70 mm]
0.4000 in. [10.16 mm]
0.0630 in. [1.60 mm]
1.8000 in. [45.72 mm]
2.0200 in. [51.31 mm]

Max. Case Length: 2.020"
Trim-to Length: 2.010"
Max. Cart. Length: 2.560"
RCBS Shellholder: #2
Barrel Length: 14"
Twist: 1-12"

Test Firearm: Thompson/Center Contender
Case: W-W
Primers: CCI 200

.375" Dia. **235 Grain** Sect. Density .239	**375 Semi Spitz-SP**					
Ballistic Coefficient	0.317					
C.O.L. Tested At	2.600"					
Speer Part No.	2471					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Re7	**35.0C**	**1884**	AA 2015BR	**36.0C**	**1776**	IMR 4895	**36.0C**	**1692**
	31.0	1628		32.0	1592		32.0	1418
IMR 4198	**32.0C**	**1808**	H322	**35.0C**	**1737**	IMR 3031	**35.0C**	**1636**
	28.0	1543		31.0	1484		31.0	1375
Viht. N133	**37.0C**	**1793**	AA 2230	**37.5C**	**1711**			
	33.0	1600		33.5	1577			

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

40 S&W

The 40 S&W is a relative newcomer to the semi-auto pistol arena. Developed jointly by Smith & Wesson and Winchester, the cartridge was announced in January of 1990.

The 40 S&W resulted from law enforcement interest in the potent 10mm Auto cartridge. Because full-power ammo was considered too powerful for typical police use, the 10mm was down-loaded to fire 180 grain bullets at 980 feet/sec to reduce recoil and improve penetration. Even so, many 10mm pistols were considered too bulky for plain-clothes officers or those with small hands.

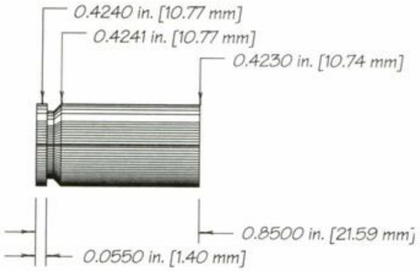
The 40 S&W concept was to put a 10mm (40 caliber) cartridge on a 9mm frame. To do this, Winchester developed a shortened 10mm loaded to the law enforcement velocity specification (980 feet/sec). Operating pressures and loaded cartridge length of the new cartridge are essentially the same as the 9mm Luger. Thus a cartridge having energy levels approaching the 45 Auto cartridge was available in a package not much larger than standard 9mm pistols.

The new guns and ammo were an immediate success. All major ammunition makers now load 40 S&W and reloading dies and components are selling extremely well. Factory ammunition is available with 155, 165 and 180 grain bullets. Speer offers two weights in the Gold Dot hollow point for hunting and defense, and in its TMJ line for plinking and target practice.

Gunwriter Charles Petty has done extensive accuracy testing with the 40 S&W and found that quick-burning powders seldom give top accuracy unless down-loaded. Handgun propellants in the middle range of burning rates performed best, and our tests here at Speer substantiate Petty's findings, especially with the Gold Dot bullets.

We are sometimes asked for loading data for the Speer 200 grain TMJ in the 40 S&W. When seated to the proper cartridge overall length, the bullet heel is so deep in the case that sidewall bulges often develop with resulting failures to feed or chamber. Velocities are also quite low, so we don't recommend this bullet for the 40 S&W.

Reloading the 40 S&W is simple, straight-forward and much like the 45 Auto. As with other semi-auto cartridges, taper crimping is recommended. Note that the 40 S&W uses small pistol primers compared to the 10mm which uses large primers. The loads shown do not exceed the industry pressure maximum of 35,000 psi.


0.4240 in. [10.77 mm]
0.4241 in. [10.77 mm]
0.4230 in. [10.74 mm]
0.8500 in. [21.59 mm]
0.0550 in. [1.40 mm]

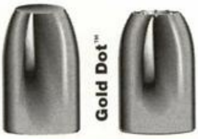
Max. Case Length: 0.850"
Trim-to Length: 0.840"
Max. Cart. Length: 1.135"
RCBS Shellholder: #27
Barrel Length: 4"
Twist: 1-16"

Test Firearm: Smith & Wesson Model 4006
Case: Speer
Primers: CCI 500

.400" Dia. **155 Grain** Sect. Density .138	**40/10mm TMJ**	**40/10mm GD-HP**				
Ballistic Coefficient	0.125	0.123				
C.O.L. Tested At	1.120"	1.120"				
Speer Part No.	4399	4400				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**11.0**	**1221**	WSF	**7.5**	**1090**	231	**6.5**	**1038**
	10.0	1113		6.7	981		5.8	867
Unique	**8.0**	**1207**	AA #7	**11.0**	**1089**	HS-6	**9.0**	**1033**
	7.2	1048		10.0	984		7.3	786
H. Universal	**7.0**	**1159**	Viht. N350	**7.7**	**1082**	Bullseye	**6.0**	**1023**
	6.2	995		6.9	871		5.4	905
AA #5	**8.7**	**1116**	HS-7	**10.0**	**1051**	AA #2	**6.5**	**956**
	7.9	956		9.0	921		5.8	840

Notes: Bold print denotes maximum loads. They should be used with caution.



.400" Dia. **180 Grain** Sect. Density .161	**40/10mm TMJ**	**40/10mm GD-HP**				
Ballistic Coefficient	0.143	0.143				
C.O.L. Tested At	1.120"	1.120"				
Speer Part No.	4402	4406				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-7	**9.3**	**1027**	**WAP**	**7.1**	**1009**	**AA #5**	**7.8**	**969**
	8.3	894		6.3	838		7.0	791
540	**8.3**	**1020**	**Unique**	**6.7**	**1000**	**Viht. 3N37**	**7.2**	**960**
	7.5	934		6.0	849		6.6	841
700-X	**5.5**	**1020**	**Viht. N350**	**6.9**	**987**	**PB**	**5.5**	**951**
	5.0	953		6.2	804		5.0	878
WSF	**6.4**	**1019**	**SR 7625**	**6.0**	**981**	**Bullseye**	**5.5**	**929**
	5.8	935		5.4	884		4.9	783
Blue Dot	**8.9**	**1018**	**AA #7**	**9.7**	**972**	**H. Universal**	**5.9**	**904**
	8.0	922		8.7	895		5.3	802

Notes: Bold print denotes maximum loads. They should be used with caution.

10mm AUTO

The idea of a 40 caliber, semi-auto pistol cartridge has been around for many years and some wildcat versions have briefly held the interest of pistol shooters. But it wasn't until 1983 that a commercial version appeared.

In that year, the firm of Dornaus & Dixon announced the introduction of the 10mm Auto cartridge in a heavy combat pistol, the Bren Ten. The new cartridge was not directly based on any existing cartridge and was developed for D&D by Norma of Sweden. The cartridge was capable of pushing a .400" 200 grain bullet at close to 1200 feet/sec making it just a little less powerful than hunting loads in the potent 41 Magnum revolver.

Manufacturing problems resulted in few Bren Tens actually reaching consumers. It wasn't until 1987 that Colt announced production guns in this caliber. The Delta Elite is a basic M1911 design beefed up to handle the high-pressure 10mm cartridge. Within 18 months, most other U.S. pistol makers offered a 10mm and several ammo companies were producing both hollow point and FMJ loads.

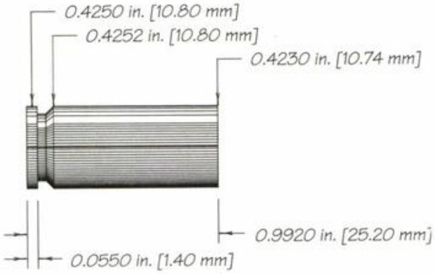
The 10mm received a lot of press attention when the FBI began looking for a new service pistol to replace existing 9mm and 38 Special handguns. They experimented with reduced loads driving a 180 grain bullet at 980 feet/sec and ultimately found a cartridge which combined controllable recoil with excellent terminal ballistics. There isn't official name for this reduced 10mm load, but it is commonly referred to as "Subsonic", the "FBI load", or occasionally, the "10 Lite". However, the reduced-pressure, 10mm subsonic load is no weakling—it is an excellent law enforcement cartridge for departments that choose large-frame semi-autos.

The full-power 10mm Auto is among just a few semi-auto pistol cartridges which can be used on deer. Generally, 180 grain Gold Dot HP bullets offer sufficient penetration to handle smaller whitetail at close range. Check with local hunting regulations, however. The 155 grain GDHP allows very high velocity but shouldn't be used on deer because of shallow penetration at such speeds.

Many hikers who frequent bear country are choosing the 10mm as a trail gun. It is more compact than a heavy-frame revolver, holds more cartridges and its performance exceeds that of the 357 Magnum. For this application, we feel that Speer's tough, 200 grain TMJ is an excellent choice for deep penetration.

Handloaders find that medium burning rate pistol propellants give the best results. The 10mm uses large pistol primers.

These loads do not exceed the 37,500 psi pressure limit established by SAAMI.


0.4250 in. [10.80 mm]
0.4252 in. [10.80 mm]
0.4230 in. [10.74 mm]
0.9920 in. [25.20 mm]
0.0550 in. [1.40 mm]

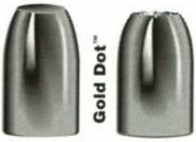
Max. Case Length: 0.992"
Trim-to Length: 0.982"
Max. Cart. Length: 1.260"
RCBS Shellholder: #27
Barrel Length: 5"
Twist: 1-16"

Test Firearm: Smith & Wesson Model 1006
Case: Hornady
Primers: CCI 300, 350

.400" Dia. **155 Grain** Sect. Density .138	**40/10mm TMJ**	**40/10mm GD-HP**				
Ballistic Coefficient	0.125	0.123				
C.O.L. Tested At	1.250"	1.250"				
Speer Part No.	4399	4400				

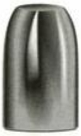
Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #7	**13.0**	**1320**	**Unique**	**8.5**	**1246**	**Viht. N340**	**8.0**	**1180**
	12.0	1187		7.5	1091		7.2	1034
Viht. 3N37	**9.8**	**1312**	**WAP**	**9.5**	**1245**	**AA #5**	**10.2**	**1176**
	8.9	1140		8.5	1073		9.2	1004
Blue Dot	**12.0**	**1291**	**HS-6***	**10.5**	**1223**	**WSF**	**8.4**	**1162**
	11.0	1164		9.5	1095		7.6	1017
HS-7*	**12.0**	**1254**	**231**	**7.7**	**1183**			
	11.0	1094		7.0	1062			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



.400" Dia. **180 Grain** Sect. Density .161	**40/10mm TMJ**	**40/10mm GD-HP**				
Ballistic Coefficient	0.143	0.143				
C.O.L. Tested At	1.250"	1.250"				
Speer Part No.	4402	4406				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**11.0**	**1295**	**Viht. 3N37**	**10.0**	**1150**	**WSF**	**7.5**	**1120**
	10.0	1105		9.0	1027		6.8	1001
2400*	**12.8**	**1214**	**Unique**	**8.0**	**1138**	**540***	**9.4**	**1118**
	11.5	1051		7.2	1043		8.5	1010
AA #7	**12.0**	**1180**	**AA #5**	**9.6**	**1129**	**HS-6***	**9.2**	**1117**
	11.0	1065		8.6	1032		8.3	1019
HS-7*	**10.6**	**1150**	**WAP**	**8.5**	**1124**			
	9.7	1037		7.7	1012			



.400" Dia. **200 Grain** Sect. Density .179	**40/10mm TMJ**					
Ballistic Coefficient	0.208					
C.O.L. Tested At	1.250"					
Speer Part No.	4403					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #9*	**14.0**	**1216**	**AA #7**	**11.6**	**1151**	**Unique**	**7.5**	**1092**
	12.5	1083		10.5	1058		6.8	987
Blue Dot	**10.0**	**1159**	**Viht. 3N37**	**8.3**	**1094**	**HS-7***	**10.2**	**1084**
	9.0	1043		7.5	1006		9.2	1008
2400*	**12.0**	**1152**	**HS-6***	**9.1**	**1094**	**540***	**9.0**	**1077**
	11.0	1059		8.2	1006		8.1	1004

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

41 ACTION EXPRESS

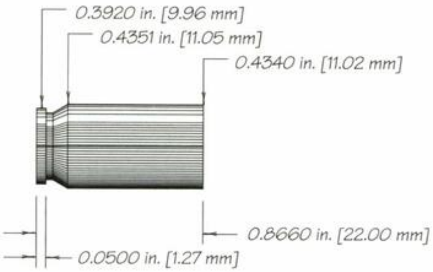
The 41 Action Express is another interesting cartridge from the fertile mind of Evan Whildin (see the section on the 50 Action Express). While working at Action Arms, Ltd., Whildin sought a way to obtain performance similar to that of the 45 Auto in a cartridge that would function in smaller pistols designed for the 9mm Luger cartridge. He also had in mind a system to allow shooters to switch to a different cartridge in one pistol by simply changing the barrel, magazine and, in some cases, the recoil spring. Firearms consultant Robert Olsen also had a hand in the research. The resulting 41 Action Express was announced in 1987, three years before the 40 S&W cartridge appeared.

This goal was accomplished in prototype form by shortening a 41 Magnum case and rebating the rim to 9mm Luger dimensions. This allowed conversion of 9mm pistols because the rebated rim fit their breech face. The overall length of the loaded round was established to match the 9mm cartridge. Originally, 170 grain JHP 41 Magnum bullets were used, but exposed lead at the nose caused feeding problems in some semi-autos. Later, Action Arms imported Israeli-made Samson ammunition with a 200 grain FMJ bullet at about 950 feet/second in production pistols. Action Arms developed a pistol for this cartridge and also marketed conversion units for Colt and Browning pistols as well as their own AT-84 9mm pistol. Several other variants of the CZ-75 design such as the Kassnar Jericho have also been available in 41 AE. Although an excellent cartridge, the 41 AE has been dropped by many pistol makers in favor of the newer 40 S&W.

The 41 AE was initially handicapped by a limited supply of loaded ammunition and a lack of bullets suitable for semi-auto pistols. The only bullets in this diameter (0.410") were intended for revolvers.

Blount engineers worked with Israeli Military Industries (IMI) to develop Speer Gold Dot 41 AE ammunition. Our factory ammunition fires a 180 grain Gold Dot hollow point bullet at a nominal velocity of 1000 feet/sec. This matches the performance of the 40 Smith & Wesson almost exactly. Speer also offers the same bullet as a reloading component.

Loading of the 41 AE is no different than other similar cartridges. Propellants which perform well in the 40 S&W also do well in the 41 AE. The loads listed do not exceed the SAAMI pressure limit of 35,000 psi.



Max. Case Length: 0.860"
Trim-to Length: 0.850"
Max. Cart. Length: 1.152"
RCBS Shellholder: #16
Barrel Length: 4.375"

Test Firearm: Jericho Model 941
Case: Speer
Primers: CCI 500

.410" Dia. **180 Grain** Sect. Density .153	**41 AE** **HP**					
Ballistic Coefficient	0.138					
C.O.L. Tested At	1.100"					
Speer Part No.	4404					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**9.1**	**1092**	**HS-7**	**9.5**	**1032**	**AA #5**	**7.8**	**1015**
	8.2	1012		8.6	950		7.1	918
Herco	**7.4**	**1079**	**HS-6**	**8.2**	**1029**	**SR 7625**	**6.0**	**1012**
	6.7	984		7.4	955		5.4	958
700-X	**5.5**	**1069**	**Bullseye**	**5.4**	**1026**	**AA #2**	**5.9**	**997**
	5.5	1008		4.9	957		5.4	951
540	**8.3**	**1052**	**PB**	**5.8**	**1024**	**WSL**	**5.1**	**993**
	7.5	937		5.3	968		4.6	910
Unique	**7.0**	**1045**	**WSF**	**6.4**	**1019**	**HP-38**	**5.6**	**991**
	6.4	1000		5.8	982		5.1	922

Notes: Bold print denotes maximum loads. They should be used with caution.

41 REMINGTON MAGNUM

The 41 Magnum answered the call of gunwriters and law enforcement officials who championed the need for a new revolver cartridge falling between the 357 and 44 Magnum in power. In 1964, Smith & Wesson and Remington announced the 41 Magnum cartridge and a new revolver, the Smith & Wesson Model 57. The revolver was identical to the 44 Magnum Model 29 except for caliber. A short time later, a less expensive model with fixed sights (the Model 58) was introduced for the law enforcement market. Ruger also chambers its popular Blackhawk revolver for the 41 Magnum.

Factory ammunition offered two performance levels: a hunting load with a 210 grain jacketed soft point with a velocity close to 1350 feet/sec and a police load with a 210 grain lead semi-wadcutter at around 1000 feet/sec.

The cartridge never realized its anticipated acceptance in the police community. Although its "street" performance was excellent, many officers found the recoil difficult to control even with the lighter load. In addition, 41 Magnums were built on the 44 frame and personnel with small hands simply couldn't get a secure grip on the big revolvers.

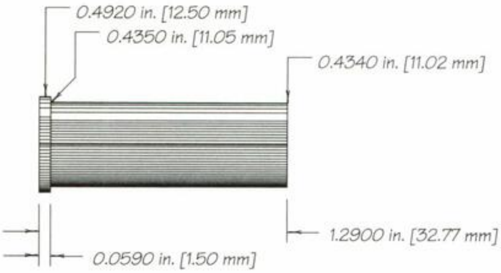
Among handgun hunters, the 41 is much more successful. Hunting loads are nearly as effective on deer as 44 Magnum full-power loads, and its supporters feel its trajectory is flatter. In the 1980's, there was enough new interest in the 41 Magnum to entice the major ammunition companies to bring out additional loads including hollow points.

For handloading, the Speer 200 grain HP and the 220 grain SP are both very effective deer bullets. Like the 44 Magnum, full-power loads are best assembled with slow-burning handgun powders. A heavy roll crimp should be applied when using these powders.

Speer's 180 grain Gold Dot HP for the 41 Action Express can also be used. Use the loads for the 200 grain bullet and seat the bullet to an cartridge overall length of 1.500", roll-crimping over the ogive. This bullet was designed for lower velocities, so it is quite explosive at 41 Magnum speeds. We don't recommend this bullet for game animals but it makes a dandy varmint load.

In its first decade, the 41 Magnum was not widely reloaded due to a shortage of component brass. Today, there are plenty of cases available, and the cartridge's popularity seems to be on the rise. We think it will be with us for a long time to come.

These loads are within the 36,000 psi pressure limit established by SAAMI.


0.4920 in. [12.50 mm]
0.4350 in. [11.05 mm]
0.4340 in. [11.02 mm]
1.2900 in. [32.77 mm]
0.0590 in. [1.50 mm]

Max. Case Length: 1.290"
Trim-to Length: 1.280"
Max. Cart. Length: 1.590"
RCBS Shellholder: #30
Barrel Length: 6"
Twist: 1-18.75"

Test Firearm: Smith & Wesson Model 57
Case: W-W
Primers: CCI 350

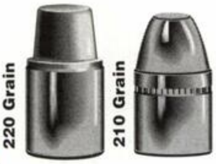
180 Grain
200 Grain

Note: Velocities listed are recorded with the 200 gr. bullet.

.410" Dia. **180 Grain** **200 Grain**	**41 AE HP**	**41 JHP-SWC**				
Sectional Density	0.153	0.170				
Ballistic Coefficient	0.138	0.113				
C.O.L. Tested At	1.500"	1.590"				
Speer Part No.	4404	4405				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**22.0**	**1428**	**2400***	**16.8**	**1311**	**IMR 4227***	**20.0**	**1254**
	20.0	1302		15.1	1203		18.0	1133
H110*	**22.0**	**1412**	**AA #9***	**16.3**	**1280**	**Unique***	**9.0**	**1181**
	20.0	1290		14.6	1155		8.5	1117
Viht. N110*	**17.9**	**1328**	**Blue Dot***	**12.1**	**1279**	**Viht. N350***	**10.1**	**1180**
	16.1	1197		10.8	1177		9.0	1049

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



Note: Velocities listed are recorded with the 220 gr. bullet.

.410" Dia. 220 Grain 210 Grain

	41 JSP-SWC	41 TMJ-Sil.				
Sectional Density	0.178	0.187				
Ballistic Coefficient	0.216	0.137				
C.O.L. Tested At	1.590"	1.695"				
Speer Part No.	4417	4420				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**20.5**	**1360**	**2400***	**15.8**	**1215**	**Viht. N110***	**14.8**	**1155**
	18.5	1247		14.2	1139		13.3	963
H110*	**20.5**	**1352**	**AA #9***	**15.9**	**1212**	**Unique**	**8.5**	**1081**
	18.5	1235		14.3	1089		8.0	1023
IMR 4227*	**19.0**	**1240**	**Blue Dot***	**11.4**	**1203**	**Viht. N350***	**9.5**	**1076**
	17.0	1197		10.2	1068		8.5	960

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

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44 S&W SPECIAL

This fine old cartridge is derived from an even older cartridge, the 44 S&W or "Russian", that enjoyed an excellent reputation as a target cartridge. With the advent of smokeless powder, the stubby Russian case proved to be too small to permit effective performance. Thus the case was lengthened and the 44 S&W Special appeared in the first decade of the 20th Century. Smith & Wesson and Colt both chambered service and target revolvers for the new cartridge.

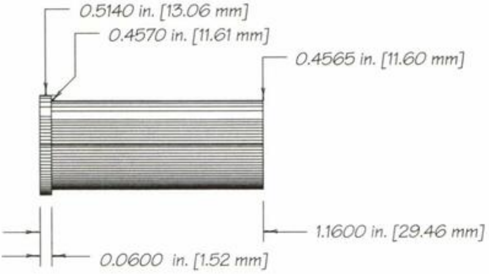
The 44 Special is every bit as accurate as its predecessor and the larger case capacity caught the interest of experimenters. Elmer Keith and others loaded heavy charges of rifle propellants and found that the cartridge delivered excellent game performance with heavy, flat-point bullets. However, major ammo companies declined to load factory ammunition to these pressure levels. Not all 44 Special revolvers were as well-made as those Keith used and there was concern that high-pressure loads might find their way into poorly-made imported revolvers. Ultimately, Keith's work with heavy 44 Special loads saw the light of day as the 44 Magnum in 1956.

Factory 44 Special ammo operates at very low pressures. For years, the only available load was a 246 grain lead round nose which seldom broke 700 feet/sec in a 4 inch barrel. Today, several ammo makers (including CCI) offer 200 grain loads with hollow point bullets, thus increasing the effectiveness of the cartridge without exceeding industry pressure limits.

Interest in the 44 Special has been rekindled with the introduction of compact, 5-shot revolvers from Charter, Taurus and Rossi. Normally sporting 3-inch barrels, these little powerhouses offer big performance in a small package. However, they should not be used with loads exceeding SAAMI pressures. Handloaders commonly pick the 200 grain JHP to keep recoil down and velocity up. The 240 grain lead SWC is also a good choice for low-velocity loads. We used a three-inch Taurus for velocity testing; velocities in six-inch barrels are normally 15 to 20 percent higher than those shown.

The SAAMI pressure limit for the 44 Special is 15,500 psi. These loads are within these guidelines.

44 S&W SPECIAL


0.5140 in. [13.06 mm]
0.4570 in. [11.61 mm]
0.4565 in. [11.60 mm]
1.1600 in. [29.46 mm]
0.0600 in. [1.52 mm]

Max. Case Length: 1.160"
Trim-to Length: 1.150"
Max. Cart. Length: 1.615"
RCBS Shellholder: #18
Barrel Length: 3"

Test Firearm: Taurus
Case: R-P
Primers: CCI 300, 350

.430" Dia. **240 Grain** Sect. Density .185	**44** **L-SWC**					
Ballistic Coefficient	0.151					
C.O.L. Tested At	1.475"					
Speer Part No.	4660					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-7*	**9.5**	**841**	**HS-6***	**8.0**	**815**	**Bullseye**	**5.2**	**793**
	8.5	749		7.0	695		4.7	691
Unique	**6.3**	**820**	**2400***	**11.7**	**799**	**Red Dot**	**5.0**	**750**
	5.7	746		11.0	735		4.5	658
Herco	**6.4**	**816**	**231**	**5.7**	**796**	**700-X**	**4.6**	**734**
	5.8	730		5.2	701		4.1	640

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.429" Dia. **200 Grain** Sect. Density .155	44 Mag-JHP					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.460"					
Speer Part No.	4425					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**8.2**	**898**	**HS-6***	**10.0**	**866**	**2400***	**12.4**	**797**
	7.4	792		9.0	754		11.4	710
Viht. N350	**9.4**	**882**	**Blue Dot**	**11.0**	**860**	**231**	**7.0**	**780**
	8.4	754		9.9	755		6.3	726
AA #5	**10.3**	**878**	**Bullseye**	**6.3**	**842**			
	9.2	751		5.6	772			

Note: The .429, 240 gr. JSP-SWC (#4447) is not recommended at these low velocities.

.429" Dia. **240 Grain** Sect. Density .186	44 Mag-JHP	44 Mag-JSP				
Ballistic Coefficient	0.165	0.164				
C.O.L. Tested At	1.465"	1.465"				
Speer Part No.	4453	4457				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-6*	**9.8**	**863**	**Unique**	**7.2**	**805**	**SR 7625**	**6.9**	**759**
	8.8	757		6.4	722		6.2	674
Blue Dot	**10.3**	**843**	**2400***	**11.7**	**789**	**Viht. 3N37**	**8.2**	**757**
	9.2	758		10.5	666		7.3	643
AA #7	**11.7**	**842**	**WAP**	**8.0**	**775**	**231**	**6.4**	**749**
	10.5	727		7.2	671		5.7	670

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

44 REMINGTON MAGNUM

In the preceeding section on the 44 Special, you have read that Elmer Keith and others had experimented for years with heavy handloads. A commercial version of these high-performance loads was introduced in 1956 as the 44 Remington Magnum. Remington and Smith & Wesson teamed to develop the cartridge and the new revolver to handle it. The result was a winning combination in anyone's book.

The cartridge was envisioned as the ultimate hunting cartridge for handgunners, but it also stimulated interest for law enforcement use initially. The cost of the revolvers and ammunition combined with heavy recoil caused police interest to cool. However, handgun hunters had found THE gun and cartridge of their dreams. For light recoil practice ammo, 44 Special ammo can also be fired in 44 Magnum revolvers.

The original factory loads featured a 240 grain lead semi-wadcutter bullet fitted with a unique gas check to protect and stiffen the bullet base. However, barrel leading was (and is) a problem in factory lead-bullet ammo so jacketed bullets were introduced around 1960.

Steve Moore, CCI/Speer Engineer, and son Nick with the results of a prototype Speer 44 cal. bullet.

Handloaders found the big cartridge easy to load and, because of pioneers like Vernon Speer and others, they had access to jacketed bullets years before similar factory loads were available

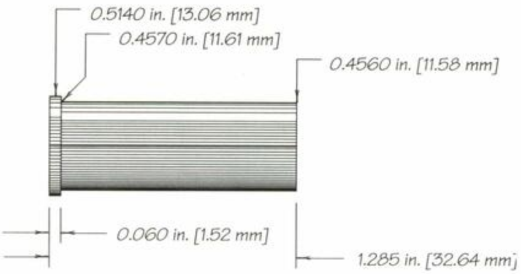
There is now a wide selection of factory ammunition for the 44 Magnum including hollow points and mid-range loads for reduced recoil practice. However, the handloader still has greater flexibility.

For lighter game, the Speer 200 grain JHP gives excellent performance combined with tolerable recoil. For taking game up to medium and large deer, the 240 grain hollow point or soft point should be used. When really deep penetration is required, the Speer 300 grain Uni-Cor soft point fills the niche.

When loading the 300 grain bullet in most revolvers, crimp in the rear cannelure. Exceptions are the Colt Anaconda and Wesson Arms revolvers. These have very tight chamber throats but, although quite accurate as a result, 300 grain bullets may not fully enter the chamber throat when seated long. The tight throats may also require a moderate reduction in maximum charge weights. When loading for Colt and Wesson Arms revolvers, seat the bullet in the FRONT cannelure, and use the 300 grain data in the 44 Magnum RIFLE section of this manual. Be sure to begin with the starting loads.

The 240 grain lead semi-wadcutter at 900 to 1000 feet/sec makes a nice plinking and small game load. We recommend that swaged lead bullets be loaded to no more than 1000 feet/sec to minimize barrel leading.

The industry maximum average pressure for the 44 Magnum is 36,000 psi; these loads do not exceed that limit.


0.5140 in. [13.06 mm]
0.4570 in. [11.61 mm]
0.4560 in. [11.58 mm]
0.060 in. [1.52 mm]
1.285 in. [32.64 mm]

Max. Case Length: 1.285"
Trim-to Length: 1.275"
Max. Cart. Length: 1.610"
RCBS Shellholder: #18
Barrel Length: 7.50"
Twist: 1-20"

Test Firearm: Ruger Redhawk
Case: Speer
Primers: CCI 350

.430" Dia. **240 Grain** Sect. Density .185	**44** **L-SWC**					
Ballistic Coefficient	0.151					
C.O.L. Tested At	1.605"					
Speer Part No.	4660					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-6*	**9.5**	**947**	**Red Dot***	**6.5**	**905**	**Bullseye***	**6.0**	**894**
	8.5	822		6.0	871		5.5	828
SR 4756*	**7.5**	**923**	**Green Dot***	**7.0**	**901**	**700-X***	**6.0**	**871**
	6.5	751		6.0	804		5.5	836
SR 7625*	**7.0**	**912**	**Unique***	**7.0**	**899**	**231***	**6.5**	**867**
	6.0	834		6.5	720		6.0	808

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

.429" Dia. **200 Grain** Sect. Density .155	44 Mag-JHP					
Ballistic Coefficient	0.122					
C.O.L. Tested At	1.590"					
Speer Part No.	4425					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**28.5**	**1688**	**2400***	**21.0**	**1507**	**Unique***	**12.4**	**1399**
	26.5	1590		19.0	1376		11.1	1299
296*	**28.0**	**1639**	**Blue Dot***	**16.0**	**1495**	**HS-7***	**17.0**	**1397**
	26.0	1521		14.4	1402		15.0	1258
IMR 4227*	**28.0**	**1596**	**AA #7***	**18.5**	**1446**	**231***	**11.5**	**1295**
	26.0	1473		16.5	1295		10.5	1219

.429" Dia. **225 Grain** Sect. Density .146	44 JHP-SWC					
Ballistic Coefficient	0.146					
C.O.L. Tested At	1.575"					
Speer Part No.	4435					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**24.5**	**1544**	**Viht. N110***	**20.8**	**1473**	**IMR 4227***	**24.0**	**1388**
	22.5	1450		18.8	1348		22.0	1276
296*	**24.0**	**1512**	**2400***	**19.5**	**1419**	**Unique***	**11.5**	**1268**
	22.0	1398		17.5	1333		10.5	1166

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

Note: These loads may be used with the 240 gr. JSP-SWC (#4447) by reducing maximum charges by one grain.

.429" Dia.
240 Grain

Sect. Density .186

	44 Mag-JHP	44 Mag-JSP	44 TMJ-Sil.			
Ballistic Coefficient	0.165	0.164	0.206			
C.O.L. Tested At	1.575"	1.575"	1.675"			
Speer Part No.	4453	4457	4459			

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**24.0**	**1451**	**AA #9***	**18.0**	**1284**	**Viht. N350***	**11.6**	**1212**
	22.0	1362		16.0	1174		10.4	1155
296*	**24.0**	**1420**	**2400***	**17.7**	**1271**	**Viht. 3N37***	**11.7**	**1185**
	22.0	1344		15.9	1195		10.5	1135
Viht. N110*	**20.0**	**1382**	**HS-6***	**13.7**	**1271**	**Unique***	**10.3**	**1175**
	18.0	1307		12.3	1172		9.2	1077
IMR 4227*	**23.4**	**1340**	**HS-7***	**15.8**	**1249**	**231***	**10.0**	**1138**
	21.4	1252		13.8	1124		9.0	1026
Blue Dot*	**13.7**	**1285**	**AA #7***	**16.0**	**1241**	**H. Universal***	**9.6**	**1081**
	12.3	1186		14.0	1034		8.8	1036

Note: These loads were tested on copper crusher equipment to SAAMI maximum pressure of 40,000 CUP. Seat and crimp in rear cannelure. See text for additional information.

.429" Dia.
300 Grain

Sect. Density .233

	44 Mag-SP					
Ballistic Coefficient	0.213					
C.O.L. Tested At	1.665"					
Speer Part No.	4463					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**22.5**	**1187**	**AA #9***	**18.5**	**1176**	**2400***	**19.0**	**1088**
	20.2	1038		16.6	1024		17.1	1003
H110*	**22.5**	**1187**	**IMR 4227***	**23.0**	**1172**	**AA 1680***	**25.0**	**1056**
	20.2	1040		20.7	1000		22.5	942

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

45 AUTO RIM

When the United States entered World War I in 1917, the Army was caught short of the relatively new Model 1911 service pistols. As a stop-gap measure, Colt and Smith & Wesson used their huge capacity for revolver production to fill the short-fall. Because both firms produced large-frame, double-action revolvers, it was a relatively easy matter to build guns with cylinders which could accommodate the rimless 45 caliber service cartridge. The Army designated these new firearms the Model 1917 revolvers.

Because the 45 Auto case is rimless, there was no conventional way to extract spent cases from the cylinders of a double-action revolver. To remedy this, a thin metal clip was developed to hold three cartridges in alignment with the chambers. This device (called a "half-moon clip" because of its shape) snapped into the cartridges' extraction cannelure to allow the extractor to lift the cases plus provided positive headspace support. The cylinders were machined off at the rear to provide room for both the clips and the cartridge rims.

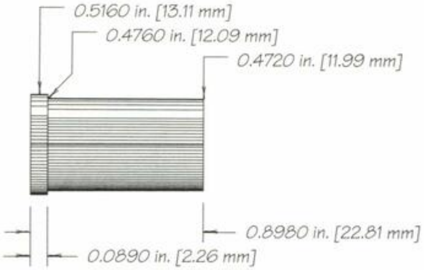
The system worked fine for military use and the big revolvers got us safely through Armistice Day. Shortly after the war, they were declared surplus and sold on the civilian market. Sport shooters soon found the clips to be a nuisance. They were hard to load, even harder to unload and were easily bent if mishandled.

In 1922 the Peters Cartridge Company introduced a new cartridge, the 45 Auto Rim, designed to fit the 1917 revolvers without using clips. It was physically the same as the 45 Auto case except for the rim. The 45 AR is a true rimmed case. However, the rim is nearly 50 percent thicker than traditional ones to fill the space in the revolver normally reserved for the clip. Jacketed bullets in revolvers were a novelty in 1922, so the new cartridge was loaded with a 230 grain lead round nose bullet. Currently, only Remington makes 45 Auto Rim ammunition and cases.

The combination was popular enough that both Smith & Wesson and Colt built commercial service and target revolvers chambered for 45 Auto Rim. Of course, 45 Auto ammo could still be used with clips. The 45 Auto Rim has a slightly lower pressure limit than the 45 Auto to reduce fouling when firing lead bullets.

Handloading the 45 AR cartridge is quite easy. 45 Auto dies can be used with a 45 AR shell holder. Since the case headspaces on the rim, cartridges can be roll crimped when the bullet has a crimping groove. If no groove is present, then light taper crimping will suffice. The 200 and 225 grain JHP bullets and the 230 grain Gold Dot HP are all excellent bullets for this cartridge. The 250 grain lead semi-wadcutter is a good choice for accurate, low-cost plinking.

The industry maximum pressure for the 45 Auto Rim is 15,000 cup. These loads are within those guidelines.



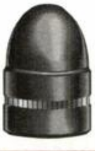
Max. Case Length: 0.898"
Trim-to Length: 0.888"
Max. Cart. Length: 1.275"
RCBS Shellholder: #8
Barrel Length: 6.50"
Twist: 1-15"

Test Firearm: Smith & Wesson
Case: R-P
Primers: CCI 300

.452" Dia. **200 Grain** Sect. Density .139	45 L-SWC					
Ballistic Coefficient	0.078					
C.O.L. Tested At	1.185"					
Speer Part No.	4677					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
SR 4756	**6.0**	**770**	Herco	**5.8**	**748**	SR 7625	**5.2**	**735**
	5.5	708		5.3	686		4.7	659
Unique	**5.5**	**767**	Bullseye	**4.6**	**745**	Green Dot	**5.1**	**733**
	5.0	701		4.1	667		4.6	672
231	**5.0**	**749**	700-X	**4.3**	**743**	Red Dot	**4.5**	**717**
	4.5	671		3.8	666		4.0	643

Notes: Bold print denotes maximum loads. They should be used with caution.
These loads do not represent maximum pressure with this bullet. The loads are at velocities preferred for target shooting.

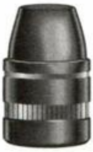


.452" Dia. 230 Grain

Sect. Density .161

	45 L-RN					
Ballistic Coefficient	0.160					
C.O.L. Tested At	1.250"					
Speer Part No.	4690					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-6	**8.6**	**872**	**Unique**	**6.6**	**787**	**Red Dot**	**5.0**	**749**
	8.1	806		6.1	723		4.5	671
231	**5.5**	**813**	**700-X**	**4.8**	**761**	**Bullseye**	**4.5**	**696**
	5.0	743		4.3	687		4.0	627

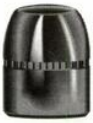


.452" Dia. 250 Grain

Sect. Density .175

	45 L-SWC					
Ballistic Coefficient	0.117					
C.O.L. Tested At	1.240"					
Speer Part No.	4683					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Herco	**6.6**	**842**	**Unique**	**6.2**	**824**	**SR 4756**	**6.7**	**782**
	6.2	791		5.8	772		6.3	691
Blue Dot	**9.0**	**824**	**HS-6**	**7.8**	**787**			
	8.6	789		7.4	700			



.451" Dia. 200 Grain

Sect. Density .140

	45 JHP					
Ballistic Coefficient	0.138					
C.O.L. Tested At	1.170"					
Speer Part No.	4477					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Herco	**7.5**	**951**	**231**	**6.0**	**899**	**700-X**	**5.0**	**860**
	7.0	890		5.5	819		4.5	772
Unique	**7.0**	**925**	**Red Dot**	**5.2**	**863**	**Bullseye**	**4.9**	**775**
	6.5	858		4.7	769		4.4	699

Notes: Bold print denotes maximum loads. They should be used with caution.

225
Grain

230
Grain

.451" Dia.
225 Grain
230 Grain

	45 Mag-JHP	45 GD-HP				
Sectional Density	0.158	0.161				
Ballistic Coefficient	0.169	0.143				
C.O.L. Tested At	1.250"	1.275"				
Speer Part No.	4479	4483				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**6.9**	**900**	**Herco**	**7.1**	**863**	**231**	**5.9**	**836**
	6.4	837		6.6	807		5.4	769
SR 7625	**5.9**	**866**	**SR 4756**	**7.0**	**850**	**Red Dot**	**5.0**	**810**
	5.4	791		6.5	782		4.5	726
HS-6	**8.6**	**865**	**Bullseye**	**5.5**	**841**	**700-X**	**4.9**	**809**
	8.0	806		5.0	768		4.4	724

.451" Dia.
260 Grain
Sect. Density .183

	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.250"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**8.5**	**696**	**Green Dot**	**5.3**	**680**	**Red Dot**	**4.6**	**651**
	8.0	656		4.8	616		DNR	—
Herco	**6.4**	**691**	**Unique**	**5.7**	**672**	**Bullseye**	**4.7**	**650**
	5.9	636		5.2	612		DNR	—

Notes: Bold print denotes maximum loads. They should be used with caution.
DNR = Do not reduce.

45 AUTO

Also know as the 45 ACP (Automatic Colt Pistol), this is among of the most popular handgun cartridges ever and one of the most widely reloaded. Developed in 1905 by John Browning for a prototype service pistol, the original version propelled a 200 grain bullet at 900 feet/sec. The original pistol design was rejected by Army Ordnance, who wanted addition safeties plus a cartridge which fired a heavier bullet. Browning redesigned the pistol to become the revered M1911 45 Auto and chose a 230 grain bullet at 850 feet/sec. The rest, as they say, is history.

For years, the only popular handguns in this caliber were Colt's military and commercial versions of the semi-auto service pistol plus some large-frame revolvers made by Colt and Smith & Wesson. In spite of many new cartridges for semi-auto pistols the 45 Auto has remained strong and today many companies chamber pistols for it. Just within the last fifteen years, Smith & Wesson, Glock, Ruger and SIG have added the 45 Auto to their line-up. Some people have predicted that the 9mm Luger cartridge will ultimately "kill off" the 45, but it hasn't happened yet. We hope it never will!

Although designed for battle, both the pistols and the cartridge have proven popular for target shooting. Many bullseye and USPSA/IPSC competitors still use the 45 Auto routinely. In an accurized pistol, the 45 Auto cartridge is capable of outstanding accuracy.

Mastering the 45 Auto pistol has never been easy. The handloader has an advantage because he can assemble light target or practice loads to minimize recoil. The Speer 200 grain lead semi-wadcutter and the 185 grain Totally Metal Jacketed (TMJ) bullets are excellent choices for target practice and bullseye competition.

Action shooting requires that ammo meet a minimum "power factor". To "make major" (weight x velocity = 175,000), competitors use the 200 grain TMJ semi-wadcutter or the 200 grain JHP bullet. Either one travelling in excess of 875 feet/sec will satisfy this requirement.

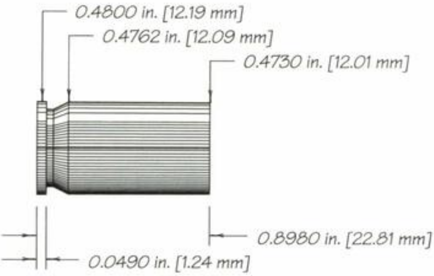
For light game hunting or defense, the 185 and 230 grain Gold Dot hollow points are designed for optimum penetration and expansion. The 225 and 260 grain JHP revolver bullets can be selected when maximum penetration is needed. However, be sure to check that the latter two bullets feed properly in your pistol. Both have exposed lead tips, and may cause jams in pistols with rough feed ramps. Semi-wadcutters bullets often require slight feed ramp polishing or other minor modifications to insure reliable feeding.

We recommend taper crimping all 45 Auto loads shown. Observe the loading lengths we show for best feeding. These loads may also be used in semi-automatic carbines chambered for the 45 Auto cartridge. However, don't expect significant velocity increases from the longer barrels. The modest pressures of the 45 Auto combined with quick-burning propellants usually mean that increases of more than 100 feet/sec are rare.

Military surplus 45 brass is quite common. Be sure to remove the primer crimp before reloading surplus cases.

The .451" 300 grain Uni-Cor soft point is not recommended for the 45 Auto. It cannot be seated to industry C.O.L. without bulging the case walls and there is little room for propellant. Even if no bulging occurred, velocities would be so low that bullets might stick in the bore.

The industry pressure limit for the 45 Auto are established at 21,000 psi; these loads are within that limit.



Max. Case Length: 0.898"
Trim-to Length: 0.888"
Max. Cart. Length: 1.275"
RCBS Shellholder: #3
Barrel Length: 4.40"
Twist: 1-15.75"

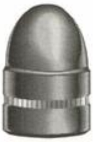
Test Firearm: SIG P-220
Case: Speer
Primers: CCI 300

Note: These are loads to velocities of approximately 800 fps. for target shooting. They are not at maximum pressure.

.452" Dia. **200 Grain** Sect. Density .139	**45 SWC**					
Ballistic Coefficient	0.139					
C.O.L. Tested At	1.185"					
Speer Part No.	4677					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Red Dot	**4.5**	**831**	**Bullseye**	**4.6**	**807**	**SR 4756**	**5.8**	**800**
	4.1	749		4.2	744		5.3	728
Herco	**6.0**	**826**	**H. Universal**	**5.4**	**804**	**Unique**	**5.4**	**790**
	5.5	750		4.9	710		4.9	716
SR 7625	**5.2**	**811**	**231**	**5.0**	**803**	**700-X**	**4.2**	**790**
	4.7	726		4.6	739		3.8	715

Notes: Bold print denotes maximum loads. They should be used with caution.

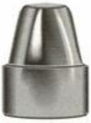


.452" Dia. 230 Grain

Sect. Density .161

	45 L-RN					
Ballistic Coefficient	0.160					
C.O.L. Tested At	1.270"					
Speer Part No.	4690					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**5.8**	**849**	**Green Dot**	**5.3**	**842**	**H. Universal**	**5.5**	**837**
	5.3	764		4.8	772		5.2	748
SR 4756	**6.5**	**848**	**Red Dot**	**5.1**	**841**	**231**	**5.6**	**831**
	6.0	783		4.7	765		5.1	760
Herco	**6.4**	**845**	**700-X**	**4.7**	**838**			
	5.9	779		4.3	767			



Note: These are loads to velocities of approximately 800 fps. for target shooting. They are not at maximum pressure.

.451" Dia. 185 Grain

Sect. Density .130

	45 TMJ Match					
Ballistic Coefficient	0.090					
C.O.L. Tested At	1.275"					
Speer Part No.	4473					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
231	**5.5**	**807**	**Unique**	**5.8**	**796**	**SR 7625**	**5.6**	**793**
	5.0	717		5.0	671		5.1	705
Red Dot	**4.9**	**803**	**Bullseye**	**4.9**	**795**	**HP-38**	**5.4**	**792**
	4.5	758		4.5	770		4.9	730
700-X	**4.7**	**798**	**AA #5**	**8.0**	**793**	**PB**	**5.5**	**770**
	4.3	731		7.2	691		5.0	719

Notes: Bold print denotes maximum loads. They should be used with caution.

.451" Dia. 185 Grain

Sect. Density .130

	45 GD-HP					
Ballistic Coefficient	0.109					
C.O.L. Tested At	1.200"					
Speer Part No.	4470					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
AA #5	**10.6**	**1034**	SR 7625	**7.8**	**981**	AA #7	**12.0**	**947**
	9.5	956		7.0	810		10.8	825
Unique	**8.2**	**1015**	WAP	**9.0**	**973**	HS-6	**9.9**	**926**
	7.3	904		8.1	823		8.9	832
700-X	**6.5**	**997**	AA #2	**6.7**	**970**	Viht. 3N37	**9.0**	**915**
	5.8	889		6.0	850		8.1	804
H. Universal	**7.7**	**991**	Viht. N330	**7.5**	**956**	Viht. N340	**7.5**	**910**
	6.9	851		6.7	854		6.7	796
Bullseye	**6.4**	**986**	231	**7.4**	**954**	WSF	**7.7**	**885**
	5.7	874		6.6	837		6.9	814

.451" Dia. 200 Grain

Sect. Density .140

	45 TMJ Match	45 JHP				
Ballistic Coefficient	0.129	0.138				
C.O.L. Tested At	1.275"	1.155"				
Speer Part No.	4475	4477				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**10.5**	**1010**	HS-6	**9.5**	**956**	Viht. 3N37	**8.2**	**910**
	9.4	877		8.5	823		7.3	769
Unique	**7.3**	**984**	Viht. N340	**7.0**	**967**	AA #5	**9.0**	**900**
	6.5	860		6.3	818		8.1	798
WAP	**8.4**	**978**	Bullseye	**5.8**	**934**	AA #7	**11.0**	**891**
	7.5	884		5.2	845		9.9	791
H. Universal	**7.0**	**967**	WSF	**7.2**	**934**	231	**6.3**	**857**
	6.3	829		6.4	824		5.6	769

Notes: Bold print denotes maximum loads. They should be used with caution.

.451" Dia. 225 Grain

Sect. Density .158

	45 Mag-JHP					
Ballistic Coefficient	0.169					
C.O.L. Tested At	1.200"					
Speer Part No.	4479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**10.0**	**935**	**AA #5**	**9.0**	**887**	**H. Universal**	**6.5**	**845**
	9.0	814		8.1	773		5.8	725
WAP	**8.1**	**930**	**AA #7**	**10.7**	**877**	**HS-6**	**9.0**	**841**
	7.2	800		9.7	736		8.0	740
Viht. N350	**8.0**	**907**	**WSF**	**7.0**	**860**	**Viht. 3N37**	**8.0**	**840**
	7.2	797		6.3	774		7.2	733
Unique	**7.2**	**906**	**Bullseye**	**5.6**	**856**	**231**	**6.0**	**787**
	6.4	835		5.0	782		5.4	730

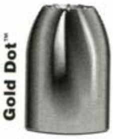
.451" Dia. 230 Grain

Sect. Density .162

	45 TMJ					
Ballistic Coefficient	0.195					
C.O.L. Tested At	1.260"					
Speer Part No.	4480					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
WAP	**7.5**	**890**	**231**	**6.2**	**858**	**Red Dot**	**5.3**	**839**
	6.8	785		5.6	789		4.8	770
Viht. N340	**6.3**	**872**	**H. Universal**	**6.3**	**841**	**Unique**	**6.5**	**832**
	5.5	760		5.5	730		5.5	728
HS-6	**8.5**	**863**	**Bullseye**	**5.7**	**840**	**700-X**	**5.1**	**815**
	7.8	773		5.2	779		4.6	710

Notes: Bold print denotes maximum loads. They should be used with caution.

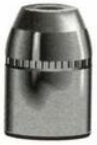


.451" Dia. 230 Grain

Sect. Density .162

	45 GD-HP					
Ballistic Coefficient	0.143					
C.O.L. Tested At	1.200"					
Speer Part No.	4483					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**9.0**	**893**	**700-X**	**5.0**	**818**	**SR 7625**	**6.0**	**796**
	8.1	796		4.5	748		5.4	664
WAP	**7.2**	**862**	**Bullseye**	**5.0**	**812**	**AA #7**	**9.6**	**794**
	6.4	746		4.5	742		8.6	690
HS-7	**9.5**	**849**	**H. Universal**	**6.0**	**806**	**AA #5**	**7.8**	**792**
	8.5	724		5.4	704		7.0	687
Viht. N340	**6.1**	**836**	**Unique**	**6.0**	**806**	**231**	**5.6**	**765**
	5.4	709		5.4	721		5.0	683
Viht. N350	**7.1**	**826**	**HS-6**	**8.0**	**799**			
	6.3	730		7.2	702			



.451" Dia. 260 Grain

Sect. Density .183

	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.200"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Herco	**6.9**	**847**	**Green Dot**	**5.8**	**819**	**700-X**	**4.9**	**794**
	6.3	775		5.3	751		4.4	722
231	**5.9**	**824**	**SR 7625**	**5.6**	**802**	**Bullseye**	**5.2**	**788**
	5.4	756		5.1	733		4.7	717
Unique	**6.3**	**821**	**Red Dot**	**5.0**	**801**			
	5.8	752		4.6	748			

Notes: Bold print denotes maximum loads. They should be used with caution.

45 COLT

In 1873, the U.S. Army adopted the famous Colt Single Action Army revolver as its service sidearm. It was chambered for the new 45 Colt cartridge, which held an impressive quantity of black powder under a 255 grain lead bullet. The new combination proved to be both powerful and accurate, serving for 17 years before being replaced by a 38 caliber revolver. Like other service cartridges, the 45 Colt became popular with civilians. It is the oldest centerfire handgun cartridge still in regular use today.

Today the 45 Colt is gaining ground among sport shooters. Cowboy IPSC and cowboy silhouette competition calls for single action firearms and the 45 Colt is certainly the most nostalgic yet still offers good performance. Colt single action revolvers are still available along with several well-made imported copies. Ruger has sold thousands of their modern Blackhawk revolvers chambered for 45 Colt. In the 1970's, Smith & Wesson introduced the double-action Model 25-5 in the large "N-frame" series which stayed in the line until 1991.

Factory ammunition was limited to a 250 or 255 grain lead bullet for many years. Velocities run around 800 to 850 feet/sec in a six-inch barrel. Increased interest in the cartridge caused ammo makers to design newer bullet styles including hollow points starting in the 1970's.

Prior to World War II, most Colt revolvers had a bore diameter of .454 inches. Post-war guns measure .451" to .452"—the same as the 45 Auto. Many older loading dies are designed for use with the larger bullets and may not size and/or expand the case to grip the smaller bullets properly. Your expander ball should be no larger than .450" diameter to properly load .451" bullets.

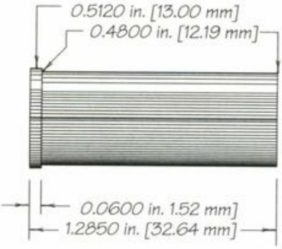
Speer's most popular jacketed bullets for standard pressure loads in the 45 Colt are the 200 and 225 grain jacketed hollow points. Both bullets can be loaded to sufficient velocities at normal pressures to give good performance. The 260 gain hollow point can also be used but may not fully expand at normal 45 Colt pressures.

The 200 and 250 grain lead semi-wadcutters make nice practice and target loads. The 200 grain bullet should be should be firmly roll-crimped over the shoulder. The 250 grain bullet will shoot very close to point-of-aim in fixed-sighted revolvers; however, the 200 grain bullet may shoot somewhat low.

Bullets designed for the 45 Auto usually lack a crimping groove; thus, they are more difficult to load in a revolver cartridge. When crimping the 230 grain Gold Dot bullet, use a 45 Auto taper crimp die to adequately grip without deforming the bullet jacket.

Although within industry pressure limits, these loads must be used only in revolvers originally made for smokeless propellant. If in doubt, check with the firearm manufacturer or a qualified gunsmith before firing the revolver with *any* modern ammo.

The SAAMI maximum average pressure for the 45 Colt is 14,000 psi.



Max. Case Length: 1.285"
Trim-to Length: 1.275"
Max. Cart. Length: 1.600"
RCBS Shellholder: #20
Barrel Length: 6"
Twist: 1-15"

Test Firearm: Smith & Wesson Model 25-5
Case: W-W
Primers: CCI 300, 350

.452" Dia. **200 Grain** Sect. Density .139	**45 L-SWC**					
Ballistic Coefficient	0.139					
C.O.L. Tested At	1.515"					
Speer Part No.	4677					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	**9.5**	**1061**	Red Dot	**7.3**	**1001**	Green Dot	**8.3**	**980**
	8.0	896		6.3	859		7.3	834
HS-6	**12.2**	**1036**	231	**8.3**	**998**	SR 7625	**8.1**	**959**
	10.7	898		7.3	854		7.1	860
Herco	**9.5**	**1021**	Bullseye	**7.5**	**988**	700-X	**6.9**	**959**
	8.0	855		6.5	835		5.9	795

Notes: Bold print denotes maximum loads. They should be used with caution.

.452" Dia.
250 Grain
Sect. Density .175

	45 L-SWC					
Ballistic Coefficient	0.117					
C.O.L. Tested At	1.600"					
Speer Part No.	4683					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**12.9**	**1028**	**H. Universal**	**9.2**	**942**	**HS-7***	**12.2**	**906**
	11.9	912		8.3	826		11.2	812
Viht. 3N37	**11.5**	**1012**	**Unique**	**9.5**	**941**	**IMR 4227***	**19.0**	**904**
	10.5	889		8.6	891		17.0	775
2400*	**15.4**	**972**	**WAP**	**10.4**	**937**	**Bullseye**	**7.0**	**879**
	13.4	838		9.4	832		6.3	810
HS-6*	**12.0**	**945**	**AA #5**	**11.6**	**927**	**231**	**8.0**	**852**
	11.0	917		10.6	840		7.2	780

.451" Dia.
200 Grain
Sect. Density .140

	45 JHP					
Ballistic Coefficient	0.138					
C.O.L. Tested At	1.555"					
Speer Part No.	4477					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HS-6*	**12.5**	**1081**	**Green Dot**	**8.8**	**991**	**Red Dot**	**7.6**	**981**
	11.0	945		7.8	868		7.1	911
Herco	**10.0**	**1032**	**SR 7625**	**8.7**	**1002**	**700-X**	**7.1**	**921**
	9.0	928		7.7	880		6.1	852
Unique	**9.8**	**1048**	**Bullseye**	**7.9**	**994**	**H. Universal**	**9.2**	**985**
	8.8	940		7.4	920		8.4	892

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

225 Grain
230 Grain
Gold Dot™

.451" Dia. **225 Grain** **230 Grain**	45 Mag-JHP	45 GD-HP				
Sectional Density	0.158	0.162				
Ballistic Coefficient	0.169	0.143				
C.O.L. Tested At	1.590"	1.600"				
Speer Part No.	4479	4483				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**13.0**	**1036**	Unique	**9.0**	**932**	2400*	**14.8**	**912**
	12.0	967		8.1	827		13.8	838
Viht. N110	**18.0**	**946**	Herco	**9.4**	**918**	Bullseye	**7.1**	**890**
	16.0	778		8.4	839		6.4	825
HS-6*	**11.8**	**936**	AA #5	**11.8**	**912**	231	**8.3**	**870**
	10.8	876		10.8	840		7.5	804

.451" Dia. **260 Grain** Sect. Density .183	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.590"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**13.0**	**941**	H. Universal	**8.9**	**897**	WAP	**9.9**	**868**
	12.0	820		8.0	753		9.0	773
HS-6*	**11.5**	**925**	Unique	**8.7**	**890**	231	**8.0**	**843**
	10.5	810		7.9	799		7.2	725
AA #5	**11.4**	**898**	Viht. 3N37	**10.4**	**875**	Bullseye	**7.1**	**841**
	10.4	797		9.4	739		6.4	785

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

45 COLT FOR RUGER & CONTENDER ONLY

With the introduction of stronger revolvers and pistols chambered for the 45 Colt cartridge, handloaders felt that the performance of the cartridge could be enhanced by loading to higher pressure levels. The Ruger Blackhawk and the Thompson/Center Contender can both handle somewhat higher pressures than traditional 45 Colt revolvers. The resulting increase in velocity makes the 45 Colt a potent hunting handgun.

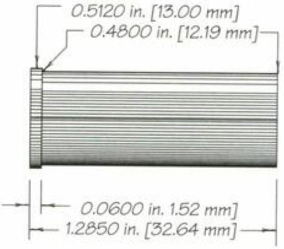
However, there are limitations. Some handloaders have assembled 45 Colt loads which exceed the pressures of the 44 Magnum! The 45 Colt case is not as strong as the 44 Magnum case and you must not attempt to load it as high, regardless of the gun model. The loads Speer developed are between 20,000 and 25,000 psi, or roughly half-way between standard 45 Colt and 44 Magnum pressures. This results in a significant increase in energy, yet the loads were safe in Speer's test firearms. If you need more power than this, buy a 44 Magnum or a 454 Casull!

The bullets we chose for these loads are designed for high-velocity use. The 185 and 230 grain Gold Dot bullets are intended for the 45 Auto and standard pressure 45 Colt loads. Penetration with either bullet is limited at high velocities and it is difficult to adequately crimp them to prevent their moving in the case under heavy recoil.

All bullets shown should be heavily roll-crimped. We crimped the 300 grain UNI-COR soft point to the REAR cannelure for a cartridge length of 1.600". Do not seat them to the front cannelure with these loads as excessive pressure will result. Loads for the 300 grain bullet were developed in a copper crusher test barrel; they operate at higher pressure than those for lighter bullets, up to 25,000 cup. Even so, they showed no pressure signs in our test revolver.

When expanding case necks, make sure that your expander plug is no larger than .450" to insure a firm grip on the bullet. We recommend that these loads be used in new or once-fired cases known to be of recent manufacture. Older cases of the "balloon head" style aren't strong enough to hold modern pressures.

These loads are intended for use only in Ruger Blackhawk and Vaquero revolvers, and the Thompson/Center Contender. They are not to be used in any other make or model of firearm! Do not substitute components, or try to load higher than the data presented.



Max. Case Length: 1.285"
Trim-to Length: 1.275"
Max. Cart. Length: 1.600"
RCBS Shellholder: #20
Barrel Length: 7.50"
Twist: 1-16"

Test Firearm: Ruger Blackhawk
Case: W-W
Primers: CCI 300, 350

.451" Dia. **200 Grain** Sect. Density .140	**45** **JHP**					
Ballistic Coefficient	0.136					
C.O.L. Tested At	1.555"					
Speer Part No.	4477					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
SR 4759	**25.5C**	**1333**	**Unique**	**11.8**	**1301**	**Herco**	**12.2**	**1245**
	23.5	1224		11.3	1259		11.7	1199
HS-6*	**14.6**	**1313**	**2400***	**20.3**	**1287**	**231**	**10.5**	**1238**
	13.6	1220		18.3	1162		10.0	1198

.451" Dia. **225 Grain** Sect. Density .169	**45** **Mag.-JHP**					
Ballistic Coefficient	0.169					
C.O.L. Tested At	1.590"					
Speer Part No.	4479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Blue Dot	**16.0**	**1343**	**Bullseye**	**10.5**	**1229**	**Unique**	**11.5**	**1191**
	14.0	1216		9.5	1165		10.5	1107
Viht. N110	**23.0C**	**1339**	**HS-6***	**14.0**	**1198**	**AA #5**	**13.5**	**1157**
	21.0	1209		13.0	1146		12.5	1085
2400*	**19.0**	**1259**	**SR 4759**	**23.5C**	**1198**	**231**	**10.5**	**1127**
	17.0	1156		21.5	1094		9.5	1011

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

.451" Dia.
260 Grain
Sect. Density .183

	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.590"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**20.5**	**1183**	**WAP**	**12.5**	**1133**	**Unique**	**10.5**	**1079**
	19.0	1096		11.5	1045		9.5	987
2400*	**18.0**	**1180**	**HS-7***	**14.7**	**1123**	**231**	**10.2**	**1067**
	16.0	1045		13.7	1021		9.2	987
H110*	**20.0**	**1151**	**Herco**	**11.0**	**1082**	**Bullseye**	**9.4**	**1064**
	18.5	1042		10.0	996		8.5	1005

Note: Seat bullet to cannelure.
These loads were developed using copper crusher equipment to a pressure of 25,000 CUP.

.451" Dia.
300 Grain
Sect. Density .211

	45 UCSP					
Ballistic Coefficient	0.199					
C.O.L. Tested At	1.600"					
Speer Part No.	4485					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
296*	**23.0**	**1193**	**2400***	**17.5**	**1048**	**H4227***	**20.5**	**985**
	20.7	1084		15.8	938		18.5	901
H110*	**23.5**	**1156**	**AA #9***	**15.5**	**1041**	**Unique**	**10.5**	**952**
	21.1	974		15.0	959		9.5	880
HS-7*	**15.5**	**1057**	**SR 4759**	**22.5**	**1029**			
	14.0	975		20.3	825			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

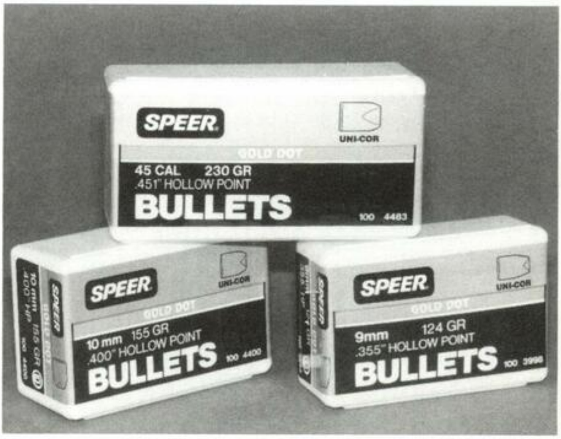
45 WINCHESTER MAGNUM

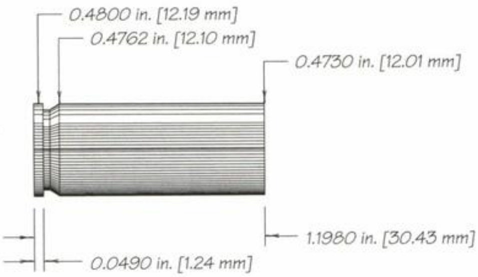
Introduced by Winchester in 1979 for the Wildey gas-operated pistol, the 45 Winchester Magnum was, for a while, the most powerful commercial semi-auto pistol cartridge. Although a very advanced design, the Wildey pistol never really reached the market in significant numbers. However, the cartridge has survived. Thompson/Center has offered Contender barrels for it, and L.A.R. Manufacturing builds the Grizzly semi-auto based on a modified and strengthened M1911 Colt design.

Because the cartridge was originally conceived for metallic silhouette competition, the only factory ammunition is loaded with a 230 grain FMJ bullet. The case is simply a strong 45 Auto case lengthened by .312". Muzzle velocity is around 1400 feet/sec.

Handloaded with hollow point or soft point bullets, the 45 Winchester Magnum is a potent hunting cartridge. With the 225 and 260 grain Speer hollow points, the cartridge can readily dispatch whitetail and mule deer and it can be used for close shots on elk and black bear with the 300 grain Uni-Cor soft point. For maximum hunting loads, Winchester 296 and Hodgdon H110 gave the best velocities. We recommend that CCI 350 Magnum primers be used when loading in this cartridge.

The 45 Winchester Magnum headspaces on the case mouth so taper crimping is mandatory for reliability and accuracy. The industry maximum average pressure for this cartridge is 40,000 cup. These loads fall within this guideline.


SPEER
UNI-COR
GOLD DOT
45 CAL 230 GR
.451" HOLLOW POINT
BULLETS
100 4483
SPEER
UNI-COR
GOLD DOT
10 mm 155 GR
.400" HOLLOW POINT
BULLETS
100 4400
SPEER
UNI-COR
GOLD DOT
9mm 124 GR
.355" HOLLOW POINT
BULLETS
100 3998


0.4800 in. [12.19 mm]
0.4762 in. [12.10 mm]
0.4730 in. [12.01 mm]
1.1980 in. [30.43 mm]
0.0490 in. [1.24 mm]

Max. Case Length: 1.198"
Trim-to Length: 1.188"
Max. Cart. Length: 1.575"
RCBS Shellholder: #36/#3
Barrel Length: 10"
Twist: 1-16"

Test Firearm: Wildey
Case: W-W
Primers: CCI 350

.451" Dia. **200 Grain** Sect. Density .140	**45** **JHP**					
Ballistic Coefficient	0.138					
C.O.L. Tested At	1.470"					
Speer Part No.	4477					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**29.5**	**1775**	**Unique***	**15.0**	**1632**	**IMR 4227***	**26.5**	**1533**
	27.5	1570		13.0	1476		24.5	1442
296*	**29.5**	**1741**	**Herco***	**16.5**	**1632**	**SR 4759***	**23.0**	**1469**
	27.5	1634		14.5	1470		21.0	1362
2400*	**24.5**	**1675**	**HS-6***	**16.5**	**1570**			
	22.5	1511		14.5	1382			

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.

225
Grain

230
Grain

Note: The 230 gr. GD-HP bullet (#4483) is not recommended at these velocities.

.451" Dia.
225 Grain
230 Grain

	45 Mag-JHP	45 TMJ				
Sectional Density	0.158	0.162				
Ballistic Coefficient	0.169	0.195				
C.O.L. Tested At	1.505"	1.570"				
Speer Part No.	4479	4480				

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**28.0**	**1646**	**296***	**28.0**	**1578**	**Herco***	**15.0**	**1480**
	26.0	1487		26.0	1423		13.0	1342
2400*	**24.0**	**1621**	**Unique***	**14.0**	**1482**	**IMR 4227***	**25.0**	**1432**
	22.0	1471		12.0	1327		23.0	1301

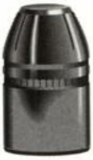
.451" Dia.
260 Grain

Sect. Density .183

	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.505"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**26.5**	**1609**	**2400***	**21.0**	**1436**	**Herco***	**13.5**	**1317**
	24.5	1447		19.0	1304		11.5	1195
296*	**26.5**	**1589**	**IMR 4227***	**24.0**	**1376**	**Unique***	**12.0**	**1281**
	24.5	1454		22.0	1248		10.0	1106

Notes: Bold print denotes maximum loads. They should be used with caution.
* CCI Magnum Primer used with this powder.



Note: Velocities from T/C
Contender with 14 inch barrel.

.451" Dia. **300 Grain** Sect. Density .211	**45** **SP**					
Ballistic Coefficient	0.199					
C.O.L. Tested At	1.485"					
Speer Part No.	4485					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**20.0**	**1367**	**AA #9***	**17.0**	**1302**	**AA 1680***	**25.0C**	**1286**
	18.0	1261		15.0	1154		23.0	1180
296*	**20.0**	**1350**	**Viht. N110***	**17.0**	**1287**	**2400***	**16.0**	**1272**
	18.0	1262		15.0	1172		14.0	1099

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

TO DO IT
SAFETY FIRST
RIGHT

454 CASULL

This massive and powerful cartridge was developed as a significant improvement over the 45 Colt cartridge. Dick Casull experimented with heavy 45 Colt loads in highly modified Colt Single Action revolvers in the search for a top-notch hunting handgun.

Eventually the 454 Casull appeared as a "stretched" 45 Colt case of very robust construction. Five-shot revolvers were developed and sold by Freedom Arms. These finely fitted revolvers are designed to handle high pressures and have a number of features to insure long equipment life under the heavy recoil of the 454 cartridge.

The cartridge is one of the best for handgun hunting and has accounted for game all around the world where handgun hunting is permitted. It can handle bullets of 300 grains and heavier for deep penetration on large game. The Freedom revolver is capable of remarkable accuracy at long ranges.

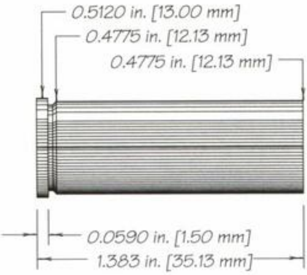
The Speer 225 and 260 grain JHP bullets are fine for lighter deer. When hunting larger game we recommend the Uni-Cor 300 grain soft point. This tough bullet gives deep penetration and can be fired in the 1500 feet/sec range in the Casull. Seat this bullet to the REAR cannelure for this cartridge.

Note that this cartridge uses small rifle primers to handle high pressures. Cases used by Speer for this manual show heavier construction than the ones we used in previous editions. The thicker case walls resulted in a reduction in charge weights from loads developed in older style cases. In spite of this, performance is still very impressive.

The recoil of the 454 Casull revolver can be quite unpleasant to an inexperienced shooter. Handloading lighter loads allows the shooter to develop a tolerance to recoil, increasing the loads toward maximum as his skill improves. The grip shape of the Freedom Arms revolver allows the revolver to slide in the hand and this helps keep the recoil within tolerable limits.

The 454 Casull is a proprietary cartridge and is not covered by SAAMI standards. Factory ammo can exceed 50,000 cup. The loads shown here are held to under 45,000 cup to provide the best performance with Speer bullets.

John Fisher used a 454 Casull and a Speer .451", 300 gr. Uni-Cor soft point on this nice sized bull elk. John's a Lewiston, ID science teacher.


0.5120 in. [13.00 mm]
0.4775 in. [12.13 mm]
0.4775 in. [12.13 mm]
0.0590 in. [1.50 mm]
1.383 in. [35.13 mm]

Max. Case Length: 1.383"
Trim-to Length: 1.373"
Max. Cart. Length: 1.680"
RCBS Shellholder: #20
Barrel Length: 7.50"
Twist: 1-24"

Test Firearm: Freedom Arms 454
Case: Freedom Arms
Primers: CCI 400

.451" Dia. **225 Grain** Sect. Density .158	**45** **Mag-JHP**					
Ballistic Coefficient	0.169					
C.O.L. Tested At	1.680"					
Speer Part No.	4479					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Viht. N110	**30.0**	**1710**	**AA #9**	**31.0**	**1689**	**H110**	**37.0**	**1681**
	28.0	1548		29.0	1528		35.0	1589
2400	**29.0**	**1693**	**296**	**36.0**	**1688**	**IMR 4227**	**34.0**	**1587**
	27.0	1526		34.0	1503		32.0	1465

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

.451" Dia.
260 Grain
Sect. Density .183

	45 Mag-JHP					
Ballistic Coefficient	0.183					
C.O.L. Tested At	1.675"					
Speer Part No.	4481					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**37.0C**	**1786**	**IMR 4227**	**33.0C**	**1571**	**AA #9**	**28.0**	**1550**
	35.0	1645		31.0	1438		26.0	1442
296	**36.0C**	**1751**	**2400**	**27.0**	**1560**	**Viht. N110**	**27.0**	**1529**
	34.0	1678		25.0	1419		25.0	1421

.451" Dia.
300 Grain
Sect. Density .211

	45 UCSP					
Ballistic Coefficient	0.213					
C.O.L. Tested At	1.750"					
Speer Part No.	4485					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110	**34.0C**	**1542**	**Viht. N110**	**27.0C**	**1451**	**AA #9**	**27.0**	**1370**
	32.0	1508		25.0	1313		25.0	1299
296	**32.0**	**1501**	**IMR 4227**	**31.0C**	**1375**	**2400**	**25.0**	**1350**
	30.0	1384		29.0	1302		23.0	1249

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load

50 ACTION EXPRESS

With the rising interest in handgun hunting, shooters continue to demand more powerful combinations of guns and ammunition to take larger game. Although much of the development centers around revolver cartridges, fans of the semiautomatic pistol can find a new level of power in the 50 Action Express cartridge.

The 50 Action Express was initially an experimental cartridge developed by Evan Whildin of Action Arms, Ltd. Working with Israeli Military Industries (IMI), he used the massive Desert Eagle gas-operated pistol as the design platform. The 50 AE is a true rebated-rim case—the rim is the same diameter as a 44 Magnum but the case body is large enough to accept a .500" diameter bullet. The result is a powerful, flat shooting cartridge for semi-auto pistol enthusiasts. Engineers at CCI-Speer worked with IMI to bring the 50 AE to the market as a commercial cartridge in 1991.

Recoil is impressive but tolerable for the experienced Magnum revolver shooter. The heavy pistol's broad grip helps spread the "felt" recoil, and the gas system helps to soften the blow. The pistol twists upward noticeably, but can be controlled with practice.

Prototype pistols and ammunition used a 0.510" bullet designed for the old 50-110 Winchester rifle cartridge. However, production pistols require a 0.500" diameter bullet. DO NOT ATTEMPT TO USE THE LARGER DIAMETER BULLETS IN PRODUCTION PISTOLS, AS EXCESSIVE PRESSURES WILL RESULT.

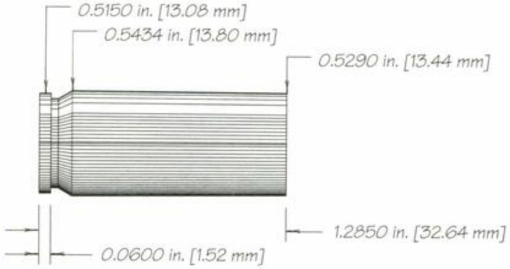
Factory ammunition is available in the Speer Gold Dot line, loaded with a 325 grain UNI-COR bullet at a nominal 1400 feet per second from a 6-inch barrel. The muzzle energy is 1414 foot-pounds. At 100 yards the 50 AE has almost as much retained energy as the typical 44 Magnum revolver has at the muzzle!

In addition to the Desert Eagle pistol, several other 50 AE pistols were introduced in 1993. L.A.R. and A.M.T. produce semi-auto pistols based on the Browning design, and Freedom Arms now manufactures it in a large, single-action revolver.

Because the Desert Eagle has a gas-operated action, smaller charges of quick-burning propellants may not generate enough gas volume to cycle the action. Winchester 296 and Hodgdon H110 powders gave excellent results in the Eagle.

The industry working pressure of the 50 AE is established at 36,000 psi. These loads do not exceed that.

CCI/Speer Engineers, (l to r) Eric Nelson, Bruce Young, and Paul Shudick along with Engineering Technician Dave Imthurn, prepare to test the 50 AE Desert Eagle.


0.5150 in. [13.08 mm]
0.5434 in. [13.80 mm]
0.5290 in. [13.44 mm]
1.2850 in. [32.64 mm]
0.0600 in. [1.52 mm]

Max. Case Length: 1.285"
Trim-to Length: 1.275"
Max. Cart. Length: 1.595"
RCBS Shellholder: #33
Barrel Length: 6"
Twist: 1-19"

Test Firearm: Magnum Research Desert Eagle
Case: Speer
Primers: CCI 350

.500" Dia. **325 Grain** Sect. Density .186	**50 AE** **UCHP**					
Ballistic Coefficient	0.149					
C.O.L. Tested At	1.575"					
Speer Part No.	4495					

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
H110*	**32.6**	**1437**	**AA 1680***	**37.8C**	**1305**	**IMR 4227***	**31.1**	**1289**
	29.4	1298		34.0	1155		29.5	1224
296*	**32.7**	**1409**	**2400***	**23.4**	**1302**	**AA #9***	**23.8**	**1247**
	29.5	1279		22.2	1222		22.6	1157

Notes: Bold print denotes maximum loads. They should be used with caution. C = Compressed Load
* CCI Magnum Primer used with this powder.

NOTES: HANDGUN DATA

RELOADING HANDGUN SHOTSHELLS

One of Speer's popular specialty lines is component shot capsules. These allow the handloader to assemble shot cartridges for 38 Special, 357 Magnum, 44 Special and 44 Magnum revolvers.

Shotshells are intended for close-range pest control. They are also popular "snake medicine" among hunters and hikers who frequent areas inhabited by poisonous snakes. Speer shot capsules are packed with 50 empty capsules and base wads per box. The reloader furnishes the desired shot size and assembles the capsules prior to loading.

The capsule is made from a brittle plastic which is designed to break on contact with the rifling yet protect the bore from excessive fouling. The base wads are made from a flexible plastic to properly seal the bore during firing. Conventional cleaning is adequate to remove any residue.

Capsules are filled by scooping them through a container of shot, leaving just enough room to fully seat the base wad. A little practice will help you find the right level of shot that still allows the wad to seat properly. Best patterns are obtained when the shot fills the capsules. Partially filled capsules will yield poor ballistic performance and irregular patterns.

After assembly, the capsules are seated much like any other projectile. However, they should be handled with some care to avoid breaking or knocking loose a base wad. We find that a flat-face seater plug works best, although a wadcutter punch seems to do nearly as well. Seat the capsules slowly; excessive force can break them. For the 38 Special and 357 Magnum, we recommend a seating length of 1.500". The 44 Special and 44 Magnum are seated to 1.600". Seating longer than this can result in the blast from one cartridge breaking the capsules in the adjoining chambers.

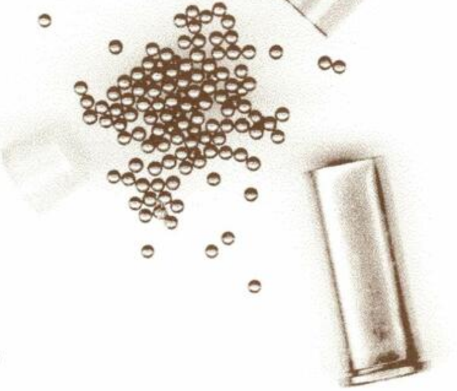
We have found that the best 38 Special cases for shotshells are those which were once factory-loaded with wadcutters. These cases often have straighter sidewalls which better accommodate the long capsules.

After seating, a moderate crimp is applied in a separate operation. This also should be done gently to avoid breaking the plastic.

You will notice that the loads shown for Speer shot capsules are relatively light. Because the capsule is fired through a rifled barrel, the entire shot charge is spinning when it leaves the barrel. Velocities in excess of those shown will only result in poor patterns. Even at proper velocities, the spin will restrict the effective range to under twenty feet.

A little experimentation will point the way to the most effective charge weight for good patterning in your revolver. Often, dropping the charge slightly improves the shot coverage.

Although the choice of shot size is up to the reloader, we recommend the smaller pellets— #'s 7 1/2, 8 and 9. Larger pellets will individually have more energy but fewer can fit in the small capsule, resulting in poor shot coverage.



Although shot patterns will vary from gun to gun depending on barrel length and other factors, a good rule of thumb in estimating pattern size is to figure one inch of spread for every foot of distance. Thus at 15 feet, the pattern would be about 15 inches in diameter.

Shotshell Capsule with Plug

Shot capsules may be used in carbines and semi-automatic pistols of the appropriate caliber. Because it has a broad, flat tip, the shotshells usually won't feed reliably from the magazine, but they can be loaded directly into the chamber for single-shot use. The light powder charges used will seldom cycle the action of a semi-auto, however.

Safety First!

Although the pellets are small, they are travelling nearly as fast as pellets fired from a 12 gauge skeet load! At very close range, they have enough power to injure— even kill— a human. Pellets may travel in excess of 200 yards, so you must be certain of your target and what is beyond. Treat these cartridges with the same respect as you would any ammunition. Wear eye and ear protection when shooting shotshells and any other ammunition.

– SHOTSHELL LOADING DATA –

38 Special/357 Magnum, #9 shot, 6" barrel

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
Unique	5.5	1111	**HP-38**	4.5	1054	**231**	5.0	996
700-X	4.5	1060	**Bullseye**	4.5	1021			

44 Special, #7 1/2, 8, or 9 shot, 4" barrel

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
HP-38	5.8	1055	**HS-6***	8.2	1029	**Unique**	6.7	1005
231	6.3	1045	**700-X**	5.3	1014			

44 Magnum, #7 1/2, 8, or 9 shot, 6" barrel

Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.	Powder	Wt. Grs.	Mzl.Vel.
231	7.3	1133	**Bullseye**	6.0	1101	**HP-38**	6.0	1061
700-X	5.7	1105	**Unique**	6.8	1097			

Note: * CCI Magnum Primer used with this powder.

SPEER PLASTIC TARGET AMMUNITION

For years, shooters have sought ways to make accurate, sub-velocity practice ammunition. The most effective way to low-cost training is Speer's Target-38™, Target-44™ and Target-45™ plastic ammunition.

Speer's training ammo for 38/357 and 44 caliber revolvers uses a unique approach. A reusable plastic bullet is seated in a reloadable plastic case of special design. The only power required is a large pistol primer— no propellant powder is used. Speer's T-cartridges can be assembled with a minimum of equipment— even a non-reloader can load and use them.

Bullets and cases are sold separately. Speer does this because T-cases last a long time, but bullets can be damaged or lost. Separate packaging means you can buy extra bullets to replace those which are no longer serviceable.

Loading is quite simple. Cases are primed in a conventional priming tool, or by placing the primers anvil-up on a hard, flat surface. Press a T-case down over a primer with your fingers, making sure that it enters the primer pocket straight. This assures proper ignition and avoids damage to the pocket. Primers should be seated flush with the case head. If you seat them with a priming tool, primers can be slightly below flush for better ignition. Avoid excessive seating force to prevent damage to the case rim. T-bullets are pressed into the case with finger pressure until they snap into place. Fired cases can be deprimed with a nail or slender punch.

We recommend the CCI 350 Magnum primers for highest velocity. However, misfires may occur in some revolvers due to light hammer springs or the cushioning effect of the plastic case. If misfires occur and you are certain that the primers were properly seated, then try CCI 300 Pistol primers. They are slightly more sensitive than Magnum primers in firearms with marginal springs. REMEMBER THAT NO PROPELLANT POWDER IS EVER USED WITH SPEER T-AMMO. A powder charge could rupture the plastic and vent hot gas into the firearm or onto the shooter.

T-ammo with a CCI Magnum primer can post velocities in excess of 400 feet/sec in some revolvers. Groups of one inch in diameter are possible at twenty feet. However, some makes and models of firearms may not shoot T-ammo as well as others. T-bullets are designed to ride on the top of the rifling instead of engaging it like a standard bullet. If the bore dimensions of a particular revolver are on the large size, the plastic bullets may not be accurate. This is not a condemnation of the guns; they were designed for conventional bullets and they generally perform quite well with them.

A simple test can tell you if your bore is compatible with Speer T-bullets. Clean and dry the bore and then press a new T-bullet into the muzzle. The bullet should slide in with light finger pressure, but not fall out when the barrel is turned muzzle-down.

T-bullets can be reused if they are fired into a bullet trap that cushions the impact. A wooden or cardboard box with strips of carpet or

rubber inner tube hung over the open end and padded with carpet at the back will catch the bullets without deforming them. With care, bullets can be used twenty times or more.

The Target-45 system is slightly different from the 38 and 44 versions. T-45 bullets are used in standard brass 45 Auto cases. Bullets are pressed into a primed, resized case with finger pressure until they stop. If primer setback occurs, open the flash hole in the case with a 7/64" drill. Do not use these modified cases for conventional loading. Mark them with a bright, permanent color or notch the rims with a file to clearly identify them as practice cases.

The resulting T-45 ammo will usually feed from a magazine if cycled manually. However, the cartridges do not generate enough energy to operate the action. If you wish to practice with a 9mm Luger, 38 Super or 380 pistol, the same loading technique can be used to seat the T-38 bullet in a brass case of the proper caliber.

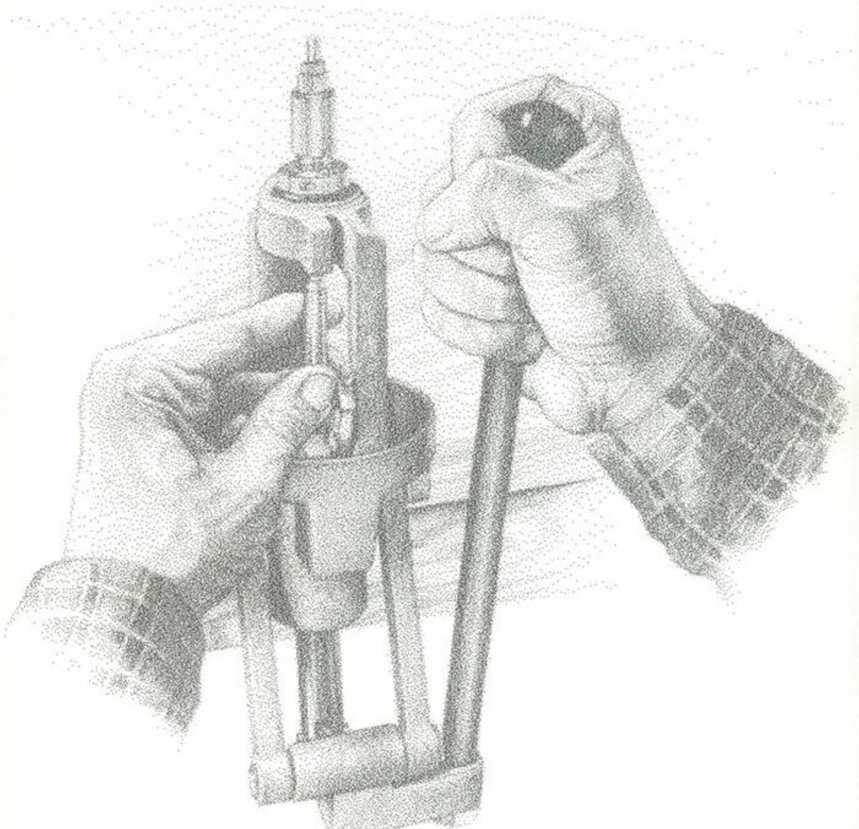
Because they produce little or no recoil, T-bullets will usually strike the target below the point of aim used with conventional ammunition. If you don't care to alter your sight settings, paste an auxiliary aiming point on the target to compensate for the lack of recoil.

Best accuracy is obtained when the barrel and chambers are kept clean. Primers fired without powder leave residue that must be removed regularly. We recommend dry-brushing the bore and chambers after every twenty-five shots. Clean the firearm thoroughly at the end of each shooting session.

Safety First!

- Speer plastic training ammunition is not a toy! It can injure skin and unprotected eyes. Show it the same respect you show any other ammunition product.
- Wear eye and ear protection. Primers alone make a loud noise and repeated exposure can damage hearing. All ammunition emits tiny particles of residue; wear approved safety/shooting glasses while shooting T-ammo. Provide eye and ear protection to anyone in the area while you are shooting.
- All component primers emit lead residue. We recommend that Speer T-ammo be used in a well-ventilated area with smooth, easily cleaned floor such as a garage. Do not use in a carpeted area. Wash hands thoroughly after shooting. For additional information on lead, see the chapter, "Safety in Reloading".
- Use Speer T-ammo in accordance with applicable local ordinances.

HANDLOADING REFERENCE SECTION



NUMBER SPEER TWELVE

METRIC CONVERSION TABLES

Handloaders and shooters constantly make measurements of many kinds in preparing and using their ammunition and in checking the results. Cartridge cases are commonly measured for length and for possible expansion. Powder charges are weighed and measured. Bullet seating depth or overall cartridge lengths are measured. Velocities and pressures are measured. Ranges are mea-sured or estimated. Many other measurements are used by advanced hand-loaders and shooters. These measurements can be made in either "English" units (the system most commonly used in the United States), or the metric system. The metric system was conceived as a measurement system to the base 10; that is, the units of the system, their multiples, and submultiples are related to each other by simple factors of 10. This conforms to our common system of numerals which is also a base 10 system. Rather than the sometimes complicated multiplication or division necessary to change units in the "English" system, the metric system requires only moving the decimal point the correct number of places.

The United States is the only industrialized country in the world not using the metric system of weights and measures. The rest of the world is committed to the metric system. To help our friends understand the metric system, the following tables were prepared showing the relationship between the more commonly used "English" system units and metric units.

Scientific Notation

Scientific Notation is a condensed way to express either very large or very small numbers. All numbers below 0.100 (10^{-1}) and above 10,000 (10^{4}) are shown here in Scientific Notation with some also shown in normal manner.

$1 = 10^{0}$
$10 = 10^{1}$
$100 = 10^{2}$
$1{,}000 = 10^{3}$
$10{,}000 = 10^{4}$
$100{,}000 = 10^{5}$
$1{,}000{,}000 = 10^{6}$

$0.1 = 10^{-1}$
$.01 = 10^{-2}$
$.001 = 10^{-3}$
$.0001 = 10^{-4}$
$.00001 = 10^{-5}$
$.000001 = 10^{-6}$
$.0000001 = 10^{-7}$

Conversion Factors for Shooters and Handloaders

Length

Multiply...	*By...*	*To Obtain...*
inches	2.540	centimeters
inches	25.40	millimeters
feet	30.48	centimeters
feet	0.3048	meters
yards	0.9144	meters
millimeters	0.03937	inches
centimeters	0.3937	inches
centimeters	0.01	meters
centimeters	10	millimeters
meters	100	centimeters
meters	3.281	feet
meters	1.094	yards
meters	39.37	inches
kilometers	3281	feet
kilometers	1094	yards
kilometers	0.6214	miles
miles	1609	meters
miles	1.609	kilometers

Velocity

feet per second	0.3048	meters per second
feet per second	0.6818	miles per hour
meters per second	3.281	feet per second
kilometers per hour	0.6214	miles per hour
miles per hour	88	feet per minute
miles per hour	1.467	feet per second
miles per hour	1.609	kilometers per hour

Weight

grains (troy)	1	grains (avoirdupois)
grains	64.8	milligrams
grains	0.0648	grams
grams	15.43	grains
grams	0.03527	ounces
ounces	437.5	grains
ounces	0.0625	pounds (avoirdupois)
ounces	28.35	grams
pounds	7000	grains
pounds	16	ounces
pounds	453.6	grams
pounds	0.4536	kilograms
kilograms	1000	grams
kilograms	2.205	pounds (avoirdupois)
tons	907.2	kilograms
metric tons	2205	pounds

Volume

cubic inches	16.39	cubic centimeters
cubic centimeters	0.0610	cubic inches
liters	1000	milliliters or cubic centimeters
liters	0.2642	gallons
liters	1.057	quarts
gallons	3.785	liters
quarts	0.9463	liters

Conversion Factors, cont'd.

Multiply...	*By...*	*To Obtain...*
Area		
square inches	6.452	square centimeters
square centimeters	0.1550	square inches
Energy		
foot pounds	0.1383	kilogram meters
kilogram meters	7.233	foot pounds
Pressure		
atmospheres	14.70	pounds per square inch
pounds per square inch	0.07032	kilograms per square centimeter
kilograms per square centimeter		14.23 pounds per square inch

Temperature

- The scale and units used to measure temperature in this country are known as the Fahrenheit scale.
- Most other countries, and practically all scientists, use a system known as the Centigrade or Celsius scale.

To convert degrees Fahrenheit (F) to degrees Celsius (C):

F° = 9 / 5 C° + 32

To convert C° to F°:

(F° -32) 5 / 9

- A comparison of these two scales:

Fahrenheit	0°	32°	59°	69.8°	98.6°	212°
Celsius	-17.7°	0°	15°	21°	37°	100°

SPEER BALLISTIC TABLES INTRODUCTION

If you have not yet read Chapter 11, please do so. The information there gives you some technical background to better understand the use of the tables. In Chapter 11, we discuss exterior ballistics in detail, including the Speer Ballistics Tables. These tables are pre-calculated to give trajectory information about a bullet at different velocities. They allow you to learn about the path of your loads without having to do complicated and repetitious calculations by hand.

Using the Tables

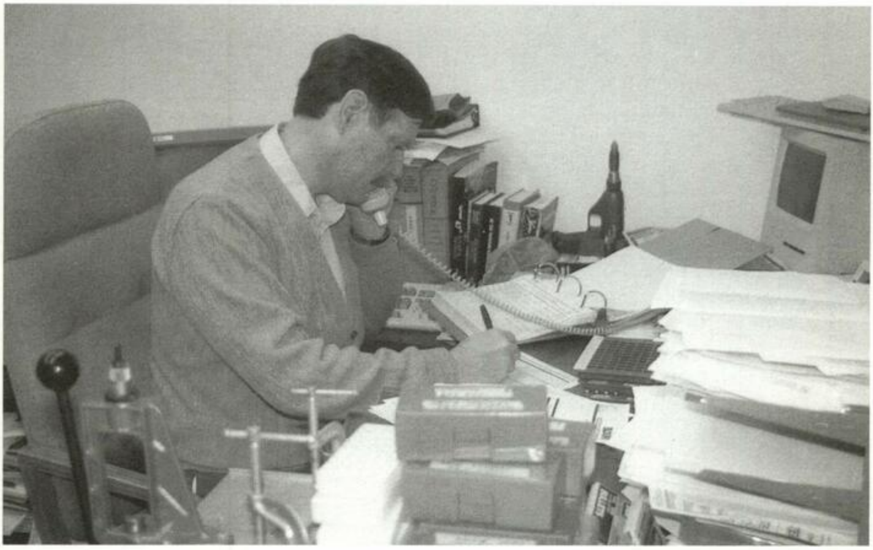
First of all, find the ballistic coefficient (BC) of the bullet you are using. The BC is listed just under the bullet pictures in the loading data. These are the BC values for Speer bullets. If you choose a bullet other than Speer, the BC will likely be different; contact the bullet maker for BC information.

Next, decide if you need path information for short-range (0 to 250 yards) or long-range (0 to 500 yards) situations. Speer has two sets of tables corresponding to these categories. The table type, either short- or long-range, is printed at the top of each page of tables. Short-range tables are listed first.

Now determine the muzzle velocity either from the loading data or from your own chronograph testing. Here is an example problem.

You are using a 280 Remington and Speer's .284" 145 grain spitzer boat tail bullet, and have worked up a maximum load of 45 grains of IMR 4350. According to the loading data, this combination gives a muzzle velocity of 2706 feet/sec. In the chart above the data, you find that the BC of this bullet is .502. Remember that the velocities shown in the data were measured in temperatures between 68° and 72° F. If you want path information in this temperature range, you can skip the next step. However, if you wish to see the effect on the path of a different temperature, refer to the chart immediately following this introduction. It is labeled "Variation of Muzzle Velocity with Temperature."

In that chart, look under the 70° column and note that there is an entry of 2722 feet/sec int the top row. To get an estimate of muzzle



Guy Neill, CCI/Speer Technical Services Administrator, answering one of many technical service calls.

Table 1

Speer Ballistic Table Example Data

Range, yards	Path, inches from LOS	TOF, seconds	Remaining Velocity
Muzzle	-1.5	0.000	2700
100	4.8	0.115	2519
200	5.5	0.238	2345
300	0.0	0.371	2178
400	-12.9	0.514	2018
500	-34.3	0.669	1865

velocity at another temperature, scan across the row to the desired new temperature. At 0° F, the load that clocked 2722 will be down to 2631, a loss of 91 feet/sec. For our example, we would use 2706 – 91, or 2615 feet/sec at a muzzle velocity at 0° F. Because velocity variation with temperature also depends on other factors such powder burning rate, these values are approximate and rounding to 2600 won't significantly affect the accuracy of the results.

Now that you have a working velocity, let's find the path of your load when the rifle is sighted for 300 yards. Go to the long-range tables and find the one for BC=.500. Within that table are a number of blocks, each corresponding to a velocity increment of 100 foot/sec. Let's use the 70° velocity of 2706 feet/sec in the data. This is very close to 2700. Scan for the section within the BC=.500 table that shows a velocity of 2700 feet/sec. In this case, it's the seventh section from the top. Go to the right and find the remaining velocity at 300 yards, 2178 feet/sec. The lower part of this section is labeled "Bullet Path (inches) +/- Line of Sight" and "Zero." We are zeroing at 300 yards, so we see the value 0.0 where the 300 yard range column meets the row for a 300 yard zero. To find the path at 100, 200, 400 and 500 yards, scan across the 300 yard row. You can also scan right and left in other rows to find the velocity and time-of-flight (TOF) at the same ranges.

These tables assume you have a scope-sighted firearm with the center of the scope 1.5 inches over the center of the bore. That's why the path point at the muzzle is -1.5 inches at the muzzle. Table 1 shows what the path, velocities and TOF look like for our example 280 Remington load.

Now you have the path plus other data about this load over typical hunting ranges.

There is another useful piece of information to be gleaned. The tables let you calculate the remaining energy at any of the above ranges. Find the row, "Energy, Ft.-Lb Per Grain" in the same section. Go across to the 300 yard range column and find the number "10.53." This means a one grain bullet with a remaining velocity of 2178 feet/sec would have an energy of 10.53 foot/lbs. Our example uses a 145 grain bullet, so 10.53 times 145 grains gives our bullet a remaining energy of 1527 foot/lbs at 300 yards.

With a little practice you'll soon find these tables to be a useful tool for making you a more confident shooter. If you own a personal computer, see the information in Chapter 11 on Speer-RCBS *PC Bullet*™, ballistics software for shooters. *PC Bullet* gives you all the information that the tables can do plus much more.

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.12

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		2900	2515	2161	1837	1549	1307
Energy, Ft-Lb Per Grain		18.67	14.04	10.37	7.49	5.33	3.79
Time of Flight, Seconds		0.0000	0.0556	0.1199	0.1952	0.2842	0.3898
Bullet Path	Z 50 YDS	-1.5	0.0	0.1	-1.7	-6.0	-14.0
(Inches) +/-	E R 100 YDS	-1.5	-0.1	0.0	-1.8	-6.2	-14.3
Line of Sight	O 150 YDS	-1.5	0.6	1.2	0.0	-3.8	-11.3
Velocity, FPS		2800	2423	2077	1761	1483	1255
Energy, Ft-Lb Per Grain		17.41	13.03	9.58	6.88	4.88	3.50
Time of Flight, Seconds		0.0000	0.0576	0.1245	0.2029	0.2958	0.4060
Bullet Path	Z 50 YDS	-1.5	0.0	0.0	-2.0	-6.9	-15.7
(Inches) +/-	E R 100 YDS	-1.5	0.0	0.0	-2.0	-6.9	-15.7
Line of Sight	O 150 YDS	-1.5	0.7	1.4	0.0	-4.2	-12.4
Velocity, FPS		2700	2331	1992	1686	1419	1206
Energy, Ft-Lb Per Grain		16.18	12.06	8.81	6.31	4.47	3.23
Time of Flight, Seconds		0.0000	0.0598	0.1294	0.2113	0.3084	0.4234
Bullet Path	Z 50 YDS	-1.5	0.0	-0.1	-2.4	-7.9	-17.6
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-2.3	-7.6	-17.3
Line of Sight	O 150 YDS	-1.5	0.8	1.5	0.0	-4.6	-13.6
Velocity, FPS		2600	2239	1908	1611	1357	1161
Energy, Ft-Lb Per Grain		15.01	11.13	8.08	5.76	4.09	2.99
Time of Flight, Seconds		0.0000	0.0622	0.1348	0.2204	0.3219	0.4419
Bullet Path	Z 50 YDS	-1.5	0.0	-0.2	-2.9	-9.0	-19.7
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-2.5	-8.5	-19.1
Line of Sight	O 150 YDS	-1.5	1.0	1.7	0.0	-5.1	-14.9
Velocity, FPS		2500	2147	1825	1538	1298	1121
Energy, Ft-Lb Per Grain		13.88	10.23	7.39	5.25	3.74	2.79
Time of Flight, Seconds		0.0000	0.0647	0.1406	0.2302	0.3365	0.4614
Bullet Path	Z 50 YDS	-1.5	0.0	-0.4	-3.4	-10.2	-22.1
(Inches) +/-	E R 100 YDS	-1.5	0.2	0.0	-2.8	-9.4	-21.1
Line of Sight	O 150 YDS	-1.5	1.1	1.9	0.0	-5.6	-16.4
Velocity, FPS		2400	2055	1742	1467	1242	1084
Energy, Ft-Lb Per Grain		12.79	9.38	6.74	4.78	3.42	2.61
Time of Flight, Seconds		0. 0000	0.0675	0.1469	0.2408	0.3522	0.4820
Bullet Path	Z 50 YDS	-1.5	0.0	-0.6	-4.0	-11.6	-24.8
(Inches) +/-	E R 100 YDS	-1.5	0.3	0.0	-3.2	-10.4	-23.3
Line of Sight	O 150 YDS	-1.5	1.4	2.1	0.0	-6.2	-18.0
Velocity, FPS		2300	1964	1660	1398	1190	1052
Energy, Ft-Lb Per Grain		11.74	8.56	6.12	4.34	3.14	2.46
Time of Flight, Seconds		0.0000	0.0706	0.1537	0.2523	0.3689	0.5036
Bullet Path	Z 50 YDS	-1.5	0.0	-0.8	-4.7	-13.2	-27.8
(Inches) +/-	E R 100 YDS	-1.5	0.4	0.0	-3.6	-11.6	-25.8
Line of Sight	O 150 YDS	-1.5	1.6	2.4	0.0	-6.9	-19.9

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.12

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2200	1873	1580	1332	1144	1022
Energy Ft-Lb Per Grain			10.75	7.79	5.54	3.94	2.91	2.32
Time of Flight, Seconds			0.0000	0.0739	0.1612	0.2648	0.3868	0.5261
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-5.5	-15.0	-31.1
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-4.0	-13.0	-28.5
Line of Sight	O	150 YDS	-1.5	1.8	2.7	0.0	-7.6	-21.8
Velocity, FPS			2100	1782	1502	1269	1102	995
Energy Ft-Lb Per Grain			9.79	7.05	5.01	3.58	2.70	2.20
Time of Flight, Seconds			0.0000	0.0776	0.1693	0.2783	0.4057	0.5494
Bullet Path	Z	50 YDS	-1.5	0.0	-1.3	-6.4	-17.0	-34.7
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-4.5	-4.5	-31.5
Line of Sight	O	150 YDS	-1.5	2.1	3.0	0.0	-8.4	-24.0
Velocity, FPS			2000	1693	1425	1210	1064	970
Energy, Ft-Lb Per Grain			8.88	6.36	4.51	3.25	2.51	2.09
Time of Flight, Seconds			0.0000	0.0816	0.1783	0.2928	0.4255	0.5736
Bullet Path	Z	50 YDS	-1.5	0.0	-1.6	-7.4	-19.3	-38.7
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-5.1	-16.1	-34.8
Line of Sight	O	150 YDS	-1.5	2.5	3.4	0.0	-9.3	26.3
Velocity, FPS			1900	1604	1351	1157	1031	947
Energy Ft-Lb Per Grain			8.01	5.71	4.05	2.97	2.36	1.99
Time of Flight, Seconds			0.0000	0.0860	0.1880	0.3084	0.4463	0.5985
Bullet Path	Z	50 YDS	-1.5	0.0	-1.9	-8.6	-21.8	-43.1
(Inches) +/-	E R	100 YDS	-1.5	1.0	0.0	-5.7	-18.0	-38.4
Line of Sight	O	150 YDS	-1.5	2.9	3.8	0.0	-10.3	-28.8
Velocity, FPS			1800	1517	1281	1110	1000	925
Energy Ft-Lb Per Grain			7.19	5.11	3.64	2.74	2.22	1.90
Time of Flight, Seconds			0.0000	0.0909	0.1987	0.3250	0.4679	0.6241
Bullet Path	Z	50 YDS	-1.5	0.0	-2.3	-9.9	-24.6	-48.0
(Inches) +/-	E R	100 YDS	-1.5	1.2	0.0	-6.5	-20.0	-42.2
Line of Sight	O	150 YDS	-1.5	3.3	4.3	0.0	-11.4	-31.4
Velocity, FPS			1700	1431	1215	1067	972	903
Energy Ft-Lb Per Grain			6.42	4.55	3.28	2.53	2.10	1.81
Time of Flight, Seconds			0.0000	0.0963	0.2103	0.3426	0.4903	0.6506
Bullet Path	Z	50 YDS	-1.5	0.0	-2.8	-11.4	-27.7	-53.2
(Inches) +/-	E R	100 YDS	-1.5	1.4	0.0	-7.3	-22.2	-46.2
Line of Sight	O	150 YDS	-1.5	3.8	4.9	0.0	-12.5	-34.1
Velocity, FPS			1600	1348	1155	1029	946	883
Energy Ft-Lb Per Grain			5.68	4.03	2.96	2.35	1.99	1.73
Time of Flight, Seconds			0.0000	0.1023	0.2230	0.3611	0.5135	0.6778
Bullet Path	Z	50 YDS	-1.5	0.0	-3.3	-13.1	-31.1	-58.9
(Inches) +/-	E R	100 YDS	-1.5	1.7	0.0	-8 .2	-24.5	-50.6
Line of Sight	O	150 YDS	-1.5	4.4	5.4	0.0	-13.6	-37.0

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.12

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1500	1268	1101	995	921	862
Energy, Ft-Lb Per Grain			5.00	3.57	2.69	2.20	1.88	1.65
Time of Flight, Seconds			0.0000	0.1090	0.2365	0.3804	0.5374	0.7060
Bullet Path	ZERO	50 YDS	1.5	0.0	-3.9	-15.0	-34.9	-65.0
(Inches) +/-		100 YDS	-1.5	2.0	0.0	-9.1	-27.0	-55.2
Line of Sight		150 YDS	-1.5	5.0	6.1	0.0	-14.9	-40.0
Velocity, FPS			1400	1192	1053	962	896	641
Energy, Ft-Lb Per Grain			4.35	3.15	2.46	2.05	1.78	1.57
Time of Flight, Seconds			0.0000	0.1165	0.2510	0.4004	0.5622	0.7352
Bullet Path	ZERO	50 YDS	-1.5	0.0	-4.6	-17.1	-38.9	-71.5
(Inches) +/-		100 YDS	-1.5	2.3	0.0	-10.1	-29.6	-60.0
Line of Sight		150 YDS	-1 5	5.7	6.8	0 .0	-16.1	-43.1
Velocity FPS			1300	1122	1008	931	870	819
Energy, Ft-Lb Per Grain			3.75	2.79	2.26	1.92	1.68	1.49
Time of Flight, Seconds			0.0000	0.1247	0.2662	0.4213	0.5882	0.7660
Bullet Path	ZERO	50 YDS	-1.5	0.0	-5.4	-19.3	-43.2	-78.7
(Inches) +/-		100 YDS	-1.5	2.7	0.0	-11.2	-32.5	-65.2
Line of Sight		150 YDS	-1.5	6.4	7.5	0.0	-17.5	-46.5
Velocity, FPS			1200	1058	966	898	843	795
Energy, Ft. Lb Per Grain			3.20	2.49	2.07	1.79	1.58	1.40
Time of Flight, Seconds			0.0000	0.1337	0.2825	0.4438	0.6163	0.7996
Bullet Path	ZERO	50 YDS	-1.5	0.0	-6.3	-21.8	-48.1	-86.7
(Inches) +/-		100 YDS	-1.5	3.1	0.0	-12.4	-35.6	-71.1
Line of Sight		150 YDS	-1.5	7.3	8.3	0.0	-19.1	-50.4
Velocity, FPS			1100	994	920	861	811	767
Energy, Ft-Lb Per Grain			2.69	2.19	1.88	1.65	1.46	1.31
Time of Flight, Seconds			0.0000	0.1439	0.3010	0.4697	0.6492	0.8395
Bullet Path	ZERO	50 YDS	-1.5	0.0	-7.3	-24.8	-54.1	-96.6
(Inches) +/-		100 YDS	-1.5	3.6	0.0	-13.9	-39.5	-78.4
Line of Sight		150 YDS	-1.5	8.3	9.3	0.0	-21.0	-55.2
Velocity, FPS			1000	925	865	815	770	729
Energy, Ft-Lb Per Grain			2.22	1.90	1.66	1.47	1.32	1.18
Time of Flight, Seconds			0.0000	0.1563	0.3242	0.5029	0.6925	0.8928
Bullet Path	ZERO	50 YDS	-1.5	0.0	-8.7	-28.9	-62.3	-110.4
(Inches) +/-		100 YDS	-1.5	4.3	0.0	-15.9	-45.0	-88.7
Line of Sight		150 YDS	-1.5	9.6	10.6	0.0	-23.7	-62.1

Exterior Ballistic Table for Ballistic Coefficient 0.13

Velocity FPS			2900	2543	2213	1909	1633	1394
Energy, Ft-Lb Per Grain			18.67	14.36	10.87	8.09	5.92	4.31
Time of Flight, Seconds			0.0000	0.0552	0.1185	0.1914	0.2764	0.3760
Bullet Path	ZERO	50 YDS	-1.5	0.0	0.1	-1.5	-5.5	-12.9
(Inches) +/-		100 YDS	-1.5	0.1	0.0	-1.7	-5.8	-13.2
Line of Sight		150 YDS	-1.5	0.5	1.1	0.0	-3.5	-10.4

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.13

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2800	2451	2128	1831	1564	1336
Energy, Ft-Lb Per Grain			17.41	13.34	10.05	7.44	5.43	3.96
Time of Flight, Seconds			0.0000	0.0573	0.1230	0.1990	0.2877	0.3916
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.8	-6.4	-14.4
(Inches) + /-	E R	100 YDS	-1.5	0.0	0.0	-1.9	-6.4	-14.6
Line of Sight	O	150 YDS	-1.5	0.6	1.3	0.0	-3.9	11.4
Velocity, FPS			2700	2359	2042	1753	1496	1281
Energy, Ft-Lb Per Grain			16.18	12.35	9.26	6.82	4.97	3.64
Time of Flight, Seconds			0.0000	0.0594	0.1278	0.2071	0.2998	0.4084
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-2.2	-7.3	16.2
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-2.1	-7.1	16.0
Line of Sight	O	150 YDS	-1.5	0.7	1.4	0.0	-4.3	-12.5
Velocity, FPS			2600	2266	1957	1676	1430	1229
Energy, Ft-Lb Per Grain			15.01	11.40	8.50	6.24	4.54	3.35
Time of Flight, Seconds			0.0000	0.0618	0.1330	0.2159	0.3129	0.4263
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.7	-8.3	-18.2
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.4	-7.9	-17.7
Line of Sight	O	150 YDS	-1.5	0.9	1.6	0.0	-4.7	-13.7
Velocity, FPS			2500	2173	1872	1601	1366	1180
Energy, Ft-Lb Per Grain			13.88	10.48	7.78	5.69	4.14	3.09
Time of Flight, Seconds			0.0000	0.0644	0.1387	0.2254	0.3270	0.4455
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-3.2	-9.5	-20.4
(inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.7	-8.8	-19.6
Line of Sight	O	150 YDS	-1.5	1.1	1.8	0.0	-5.2	-15.1
Velocity, FPS			2400	2081	1788	1527	1305	1137
Energy Ft-Lb Per Grain			12.79	9.61	7.10	5.18	3.78	2.87
Time of Flight, Seconds			0.0000	0.0671	0.1449	0.2358	0.3422	0.4658
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.8	-10.8	-23 0
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-3.0	-9.8	-21.7
Line of Sight	O	150 YDS	-1.5	1.3	2.0	0.0	-5.8	-16.6
Velocity, FPS			2300	1988	1704	1454	1247	1097
Energy, Ft-Lb Per Grain			11.74	8.77	6.45	4.69	3.45	2.67
Time of Flight, Seconds			0.0000	0.0701	0.1517	0.2470	0.3586	0.4873
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-4.5	-12.3	-25.8
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.4	-10.9	-24.0
Line of Sight	O	150 YDS	-1.5	1.5	2.3	0.0	-6.4	-18.4
Velocity, FPS			2200	1897	1622	1384	1194	1062
Energy Ft-Lb Per Grain			10.75	7.99	5.84	4.25	3.17	2.50
Time of Flight, Seconds			0.0000	0.0734	0.1590	0.2592	0.3762	0.5099
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-5.2	-14.0	-29.0
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.8	-12.2	-26.6
Line of Sight	O	150 YDS	-1.5	1.7	2.5	0.0	-7.1	-20.3

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.13

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity FPS			2100	1805	1542	1317	1145	1031
Energy, Ft-Lb Per Grain			9.79	7.23	5.28	3.85	2.91	2.36
Time of Flight, Seconds			0.0000	0.0771	0.1670	0.2724	0.3949	0.5335
Bullet Path	Z	50 YDS	-1.5	0.0	-1.2	-6.1	-16.0	-32.5
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-4.3	.-13.6	-29.5
Line of Sight	O	150 YDS	-1.5	2.0	2.9	0.0	-7.9	-22.4
Velocity, FPS			2000	1715	1463	1254	1102	1002
Energy, Ft-Lb Per Grain			8.88	6.53	4.75	3.49	2 .70	2.23
Time of Flight, Seconds			0.0000	0.0810	0.1758	0.2868	0.4148	0.5580
Bullet Path	Z	50 YDS	-1.5	0.0	-1.5	-7.1	-18.2	-36.4
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.8	-15.2	-32.7
Line of Sight	O	150 YDS	-1.5	2.4	3.2	0.0	-8.8	-24.7
Velocity, FPS			1900	1625	1387	1196	1064	976
Energy, Ft-Lb Per Grain			8.01	5.86	4.27	3.18	2.51	2.11
Time of Flight, Seconds			0.0000	0.0854	0.1854	0.3022	0.4357	0.5833
Bullet Path	Z	50 YDS	-1.5	0.0	-1.8	-8.2	-20.6	-40.7
(Inches) +/-	E R	100 YDS	-1.5	0.9	0.0	-5.5	-17.0	-36.2
Line of Sight	O	150 YDS	-1.5	2.7	3.6	0.0	-9.7	-27.1
Velocity, FPS			1800	1537	1314	1143	1029	951
Energy, Ft-Lb Per Grain			7.19	5.24	3.83	2.90	2.35	2.01
Time of Flight, Seconds			0.0000	0.0902	0.1960	0.3188	0.4576	0.6095
Bullet Path	Z	50 YDS	-1.5	0.0	-2.2	-9.5	-23.4	-45.5
(Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-6.2	-19.0	-40.0
Line of Sight	O	150 YDS	-1.5	3.2	4.1	0.0	-10.8	-29.7
Velocity. FPS			1700	1450	1244	1095	998	928
Energy, Ft-Lb Per Grain			6.42	4.67	3.44	2.66	2.21	1.91
Time of Flight, Seconds			0.0000	0.0956	0.2075	0.3365	0.4804	0.6365
Bullet Path	Z	50 YDS	-1.5	0.0	-2.7	-10.9	-26.5	-50.7
(Inches) +/-	E R	100 YDS	-1.5	1.3	0.0	-7.0	-21.1	-44.0
Line of Sight	O	150 YDS	-1.5	3.6	4.6	0.0	-11.9	-32.4
Velocity, FPS			1600	1365	1180	1053	969	905
Energy, Ft-Lb Per Grain			5.68	4.14	3.09	2.46	2.08	1.82
Time of Flight, Seconds			0.0000	0.1016	0.2201	0.3552	0.5040	0.6644
Bullet Path	Z	50 YDS	-1.5	0.0	-3.2	-12.6	-29.9	-56.4
(Inches) +/-	E R	100 YDS	-1.5	1.6	0.0	-7.8	-23.5	-48.4
Line of Sight	O	150 YDS	-1.5	4.2	5.2	0.0	-13.0	-35.3
Velocity, FPS			1500	1283	1122	1015	941	883
Energy, Ft-Lb Per Grain			5.00	3.65	2.79	2.29	1.97	1 7.3
Time of Flight, Seconds			0.0000	0.1083	0.2338	0.3747	0.5285	0.6932
Bullet Path	Z	50 YDS	-1.5	0.0	-3.8	-14.5	-33.6	-62.5
(Inches) +/-	E R	100 YDS	-1.5	1.9	0.0	-8.8	-26.0	-53.0
Line of Sight	O	150 YDS	-1.5	4.8	5.9	0.0	-14.3	-38.4

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.13

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1400	1206	1070	980	914	861
Energy, Ft-Lb Per Grain			4.35	3.23	2.54	2.13	1.85	1.65
Time of Flight, Seconds			0.0000	0.1158	0.2483	0.3951	0.5538	0.7230
Bullet Path	Z	50 YDS	-1.5	0.0	-4.5	-16.5	-37.6	-69.1
(Inches) +/-	E R	100 YDS	-1.5	2.2	0.0	-9.8	-28.7	-57.9
Line of Sight	O	150 YDS	-1.5	5.5	6.5	0.0	-15.6	-41.5
Velocity. FPS			1300	1133	1023	947	888	838
Energy, Ft-Lb Per Grain			3.75	2.85	2.32	1.99	1.75	1.56
Time of Flight, Seconds			0.0000	0.1240	0.2638	0.4165	0.5803	0.7544
Bullet Path	Z	50 YDS	-1.5	0.0	-5.3	-18.8	-42.0	-76.3
(Inches) +/-	E R	100 YDS	-1.5	2.6	0.0	-10.9	-31.5	-63.2
Line of Sight	O	150 YDS	-1.5	6.3	7.3	0.0	-17.0	-45.0
Velocity FPS			1200	1066	978	912	859	813
Energy, Ft-Lb Per Grain			3.20	2.52	2.12	1.85	1.64	1.47
Time of Flight, Seconds			0.0000	0.1331	0.2804	0.4394	0.6089	0.7885
Bullet Path	Z	50 YDS	-1.5	0.0	-6.1	-21.3	-47.0	-84.4
(Inches) +/-	E R	100 YDS	-1.5	3.1	0.0	-12.1	-34.7	-69.1
Line of Sight	O	150 YDS	-1.5	7.1	8.1	0.0	-18.5	-48.8
Velocity, FPS			1100	1001	930	874	826	784
Energy, Ft-Lb Per Grain			2.69	2.22	1.92	1.70	1.51	1.36
Time of Flight, Seconds			0.0000	0.1434	0.2991	0.4656	0.6422	0.8288
Bullet Path	Z	50 YDS	-1.5	0.0	-7.2	-24.4	-52.9	-94.3
(Inches) +/-	E R	100 YDS	-1.5	3.6	0.0	-13.6	-38.6	-76.4
Line of Sight	O	150 YDS	-1.5	8.1	9.1	0.0	-20.5	-53.7
Velocity, FPS			1000	930	874	826	783	745
Energy, Ft-Lb Per Grain			2.22	1.92	1.70	1.51	1.36	1.23
Time of Flight, Seconds			0.0000	0.1558	0.3224	0.4991	0.6858	0.8824
Bullet Path	Z	50 YDS	-1.5	0.0	-8.6	-28.5	-61.2	-108.1
(Inches) +/-	E R	100 YDS	-1.5	4.3	0.0	-15.7	-44.1	-86.7
Line of Sight	O	150 YDS	-1.5	9.5	10.4	0.0	-23.2	-60.6

Exterior Ballistic Table for Ballistic Coefficient 0.14

Velocity, FPS			2900	2568	2259	1972	1709	1475
Energy, Ft-Lb Per Grain			18.67	14.64	11.33	8.63	6.48	4.83
Time of Flight, Seconds			0.0000	0.0550	0.1173	0.1883	0.2701	0.3646
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.4	-5.2	-11.9
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.6	-5.5	-12.4
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.3	-9.7
Velocity, FPS			2800	2475	2173	1892	1637	1412
Energy, Ft-Lb Per Grain			17.41	13.60	10.48	7.95	5.95	4.43
Time of Flight, Seconds			0.0000	0.0570	0.1217	0.1957	0.2809	0.3797
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.7	-5.9	-13.4
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-6.1	-13.6
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.7	-10.6

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2700	2382	2086	1813	1566	1352
Energy, Ft-Lb Per Grain			16.18	12.60	9.66	7.30	5.44	4.06
Time of Flight, Seconds			0.0000	0.0592	0.1264	0.2036	0.2927	0.3959
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-2.1	-6.8	-15.1
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-2.0	-6.7	-18.0
Line of Sight	O	150 YDS	-1.5	0.7	1.4	0.0	-4.0	-11.6
Velocity, FPS			2600	2289	2000	1734	1497	1294
Energy, Ft-Lb Per Grain			15.01	11.63	8.88	6.68	4.98	3.72
Time of Flight, Seconds			0.0000	0.0615	0.1316	0.2122	0.3054	0.4133
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-2.5	-7.8	-17.0
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.3	-7.5	-16.6
Line of Sight	O	150 YDS	-1.5	0.8	1.5	0.0	-4.4	-12.8
Velocity, FPS			2500	2196	1913	1656	1429	1240
Energy, Ft-Lb Per Grain			13.88	10.71	8.12	6.09	4.53	3.41
Time of Flight. Seconds			0.0000	0.0640	01372	0.2215	0.3191	04320
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-3.0	-8.9	-19.1
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.5	-8.3	-18.3
Line of Sight	O	150 YDS	-1.5	1.0	1.7	0.0	-4.9	-14.1
Velocity, FPS			2400	2103	1828	1580	1363	1190
Energy, Ft-Lb Per Grain			12.79	9.82	7.42	5.54	4.12	3.14
Time of Flight, Seconds			0.0000	0.0668	0.1433	0.2316	0.3340	0.4520
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.6	-10.2	-21.5
(Inches) + /-	E R	100 YDS	-1.5	0.2	0.0	-2.9	-9.2	-20.3
Line of Sight	O	150 YDS	-1.5	1.2	1.9	0.0	-5.4	-15.5
Velocity, FPS			2300	2010	1743	1505	1301	1144
Energy, Ft-Lb Per Grain			11.74	8.97	6.74	5.03	3.76	2.91
Time of Flight, Seconds			0.0000	0.0696	0.1499	0.2426	0.3500	0.4733
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-4.2	-11.6	-24.2
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-3.2	-10.3	-22.5
Line of Sight	O	150 YDS	-1.5	1.4	2.1	0.0	-6.0	-17.2
Velocity. FPS			2200	1917	1660	1432	1243	1103
Energy, Ft-Lb Per Grain			10.75	8.16	6.12	4.55	3.43	2.70
Time of Flight. Seconds			0.0000	0.0730	0.1572	0.2546	0.3672	0.4956
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-4.9	-13.3	-27.2
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.6	-11.5	-25.0
Line of Sight	O	150 YDS	-1.5	1.6	2.4	0.0	-6.7	-19.0
Velocity, FPS			2100	1825	1577	1362	1188	1066
Energy, Ft-Lb Per Grain			9.79	7.39	5.52	4.12	3.13	2.52
Time of Flight, Seconds			0.0000	0.0766	0.1651	0.2675	0.3858	0.5194
Bullet Path	Z	50 YDS	-1.5	0.0	-1.1	-5.8	-15.1	-30.6
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-4.1	-12.9	-27.8
Line of Sight	O	150 YDS	-1.5	1.9	2.7	0.0	-7.4	-21.0

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2000	1734	1497	1295	1139	1033
Energy, Ft-Lb Per Grain			8.88	6.68	4.98	3.72	2.88	2.37
Time of Flight, Seconds			0.0000	0.0806	0.1737	0.2816	0.4055	0.5442
Bullet Path	Z	50 YDS	-1.5	0.0	-1.4	-6.7	-17.2	-34.4
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.6	-14.4	-30.9
Line of Sight	O	150 YDS	-1.5	2.2	3.1	0.0	-8.3	-23.2
Velocity, FPS			1900	1644	1418	1232	1096	1004
Energy, Ft-Lb Per Grain			8.01	6.00	4.46	3.37	2.67	2.24
Time of Flight, Seconds			0.0000	0.0849	0.1832	0.2969	0.4265	0.5699
Bullet Path	Z	50 YDS	-1.5	0.0	-1.7	-7.8	-19.6	-38.7
(Inches) +/-	E R	100 YDS	-1.5	0.9	0.0	-5.2	-16.2	-34.3
Line of Sight	O	150 YDS	-1.5	2.6	3.5	0.0	-9.2	-25.6
Velocity, FPS			1800	1555	1343	1174	1057	976
Energy, Ft-Lb Per Grain			7.19	5.37	4.00	3.06	2.48	2.11
Time of Flight, Seconds			0.0000	0.0897	0.1937	0.3134	0.4485	0.5965
Bullet Path	Z	50 YDS	-1.5	0.0	-2.1	-9.1	-22.3	-43.4
(Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-5.9	-18.1	-38.1
Line of Sight	O	150 YDS	-1.5	3.0	3.9	0.0	-10.2	-28.2
Velocity, FPS			1700	1467	1270	1122	1022	951
Energy, Ft-Lb Per Grain			6.42	4.78	3.58	2.79	2.32	2.01
Time of Flight, Seconds			0.0000	0.0951	0.2051	0.3311	0.4716	0.6240
Bullet Path	Z	50 YDS	-1.5	0.0	-2.6	-10.5	-25.4	-48.5
(Inches) +/-	E R	100 YDS	-1.5	1.3	0.0	-6.7	-20.2	-42.1
Line of Sight	O	150 YDS	-1.5	3.5	4.5	0.0	-11.3	-31.0
Velocity, FPS			1600	1381	1203	1076	990	926
Energy, Ft-Lb Per Grain			5.68	4.23	3.21	2.57	2.18	1.90
Time of Flight, Seconds			0.0000	0.1010	0.2177	0.3500	0.4956	0.6525
Bullet Path	Z	50 YDS	-1.5	0.0	-3.1	-12.2	-28.8	-54.2
(Inches) +/-	E R	100 YDS	-1.5	1.5	0.0	-7.5	-22.6	-46.5
Line of Sight	O	150 YDS	-1.5	4.1	5.0	0.0	-12.5	-33.9
Velocity, FPS			1500	1297	1141	1035	960	903
Energy, Ft-Lb Per Grain			5.00	3.73	2.89	2.38	2.05	1.81
Time of Flight, Seconds			0.0000	0.1077	0.2313	0.3698	0.5206	0.6819
Bullet Path	Z	50 YDS	-1.5	0.0	-3.7	-14.0	-32.5	-60.3
(Inches)+/-	E R	100 YDS	-1.5	1.8	0.0	-8.5	-25.1	-51.1
Line of Sight	O	150 YDS	-1.5	4.7	5.7	0.0	-13.8	-37.0
Velocity, FPS			1400	1218	1086	997	932	879
Energy, Ft-Lb Per Grain			4.35	3.29	2.62	2.21	1.93	1.72
Time of Flight, Seconds			0.0000	0.1151	0.2460	0 3905	0.5464	0.7123
Bullet Path	Z	50 YDS	-1.5	0.0	-4.4	-16.1	-36.5	-67.0
(Inches) +/-	E R	100 YDS	-1.5	2.2	0.0	-9.5	-27.8	-56.1
Line of Sight	O	150 YDS	-1.5	5.4	6.4	0.0	-15.1	-40.2

SPEER SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1300	1143	1036	961	903	855
Energy, Ft-Lb Per Grain			3.75	2.90	2.38	2.05	1.81	1.62
Time of Flight, Seconds			0.0000	0.1234	0.2616	0 4122	0.5734	0.7442
Bullet Path	Z	50 YDS	-1.5	0.0	-5.1	-18.4	-41.0	-74.3
(Inches)+/-	E R	100 YDS	-1.5	2.6	0.0	-10.7	-30.7	-61.4
Line of Sight	O	150 YDS	-1.5	6.1	7.1	0 0	-16.5	-43.7
Velocity, FPS			1200	1074	989	925	874	829
Energy, Ft-Lb Per Grain			3.20	2.56	2.17	1.90	1.70	1.53
Time of Flight, Seconds			0.0000	0.1326	0.2784	0.4355	0.6025	0.7789
Bullet Path	Z	50 YDS	-1.5	0.0	-6.0	-20.9	-46.0	-82.4
(Inches) +/-	E R	100 YDS	-1.5	3.0	0.0	-11.9	-33.9	-67.4
Line of Sight	O	150 YDS	-1.5	7.0	7.9	0.0	-18.1	-47.6
Velocity, FPS			1100	1007	939	885	839	798
Energy, Ft-Lb Per Grain			2.69	2.25	1.96	1.74	1.56	1.41
Time of Flight, Seconds			0.0000	0.1429	0.2974	0.4620	0.6362	0.8195
Bullet Path	Z	50 YDS	-1.5	0.0	-7.1	-24 0	-52.0	-92.3
(Inches) +/-	E R	100 YDS	-1.5	3.5	0.0	-13.4	-37.8	-74 7
Line of Sight	O	150 YDS	-1.5	8.0	8.9	0.0	-20.0	-52 4
Velocity, FPS			1000	934	881	835	795	758
Energy, Ft-Lb Per Grain			2.22	1.94	1.72	1.55	1.40	1.28
Time Of Flight, Seconds			0.0000	0.1554	0.3209	0.4958	0.6800	0.8734
Bullet Path	Z	50 YDS	-1.5	0.0	-8 5	-28.1	-60.2	-106.1
(Inches) +/-	E R	100 YDS	-1.5	4.2	0.0	-15.4	-43.3	-85.0
Line of Sight	O	150 YDS	-1.5	9.4	10.3	0.0	-22.7	-59.3

Exterior Ballistic Table for Ballistic Coefficient 0.15

Velocity, FPS			2900	2589	2299	2028	1776	1549
Energy, Ft-Lb Per Grain			18.67	14.88	11.73	9.13	7.00	5.33
Time of Flight, Seconds			0.0000	0.0547	0.1162	0.1857	0.2648	0.3552
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.3	-4.8	-11.2
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.6	-5.2	-11.7
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-3.2	-9.1
Velocity, FPS			2800	2496	2212	1946	1702	1483
Energy, Ft-Lb Per Grain			17.41	13.83	10.86	8.41	6.43	4.88
Time of Flight, Seconds			0.0000	0.0567	0.1206	0.1929	0.2753	0.3698
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.6	-5.6	-12.6
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.7	-5.8	-12.9
Line of Sight	O	150 YDS	-1.5	0.5	1.2	0.0	-3.5	-10.0
Velocity, FPS			2700	2403	2124	1865	1629	1419
Energy, Ft-Lb Per Grain			16.18	12.82	10.02	7.72	5.89	4.47
Time of Flight, Seconds			0.0000	0.0589	0.1253	0.2007	0.2868	0.3855
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-2.0	-6.4	-14.2
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.9	-6.4	-14.2
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.8	-10.9

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.15

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2600	2309	2037	1785	1557	1357
Energy, Ft-Lb Per Grain			15.01	11.84	9.21	7.07	5.38	4.09
Time of Flight, Seconds			0.0000	0.0612	0.1304	0.2091	0.2991	0.4024
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.1	-2.4	-7.4	-16.0
(Inches) +/-		100 YDS	-1.5	0.1	0.0	-2.2	-7.1	-15.6
Line of Sight		150 YDS	-1.5	0.8	1.5	0.0	-4.2	-12.0
Velocity, FPS			2500	2215	1950	1705	1486	1298
Energy, Ft-Lb Per Grain			13.88	10.89	8.44	6.45	4.90	3.74
Time of Flight, Seconds			0.0000	0.0637	0.1359	0.2182	0.3125	0.4207
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.3	-2.9	-8.5	-18.0
(Inches) +/-		100 YDS	-1.5	0.1	0.0	-2.4	-7.9	-17.3
Line of Sight		150 YDS	-1.5	1.0	1.6	0.0	-4.6	-13.2
Velocity, FPS			2400	2122	1863	1627	1417	1242
Energy, Ft-Lb Per Grain			12.79	10.00	7.71	5.88	4.46	3.42
Time of Flight, Seconds			0.0000	0.0665	0.1419	0.2281	0.3270	0.4402
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.4	-3.4	-9.7	-20.3
(Inches) +/-		100 YDS	-1.5	0.2	0.0	-2.7	-8.8	-19.2
Line of Sight		150 YDS	-1.5	1.1	1.8	0.0	-5.1	-14.6
Velocity, FPS			2300	2028	1777	1550	1351	1190
Energy, Ft-Lb Per Grain			11.74	9.13	7.01	5.33	4.05	3.14
Time of Flight, Seconds			0.0000	0.0695	0.1485	0.2389	0.3127	0.4612
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.6	-4.0	-11.1	-22.9
(Inches) +/-		100 YDS	-1.5	0.3	0.0	-3.1	-9.8	-21.3
Line of Sight		150 YDS	-1 5	1.3	2.1	0.0	-5.7	-16.2
Velocity, FPS			2200	1935	1692	1475	1289	1144
Energy. Ft-Lb Per Grain			10.75	8.31	6.36	4.83	3.69	2.91
Time of Flight, Seconds			0.0000	0.0727	0.1556	0.2506	0.3596	0.4835
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.8	-4.7	-12.6	-25.8
(Inches) +/-		100 YDS	-1.5	0.4	0.0	-3.5	-11.0	23.7
Line of Sight		150 YDS	-1.5	1.6	2.3	0.0	-6.3	-17.9
Velocity, FPS			2100	1843	1609	1402	1230	1102
Energy, Ft-Lb Per Grain			9.79	7.54	5.75	4.36	3.36	2.70
Time of Flight, Seconds			0.0000	0 0763	0.1634	0.2634	0.3778	0.5071
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.1	5.6	14.7	-29.1
(Inches) +/-		100 YDS	-1.5	0.5	0.0	-3.9	-12.3	-26.4
Line of Sight		150 YDS	-1.5	1.8	2.6	0.0	-7.1	-19 9
Velocity, FPS			2000	1751	1527	1332	1176	1064
Energy, Ft-Lb Per Grain			8.88	6.81	5.18	3.94	3.07	2.51
Time of Flight, Seconds			0.0000	0.0802	0.1720	0.2773	0.3974	0.5319
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.4	-6.5	-16.5	-32.8
(Inches) +/-		100 YDS	-1.5	0.7	0.0	-4.4	-13.8	-29.4
Line of Sight		150 YDS	-1.5	2.2	3.0	0.0	-7 9	-22.0

Exterior Ballistic Table for Ballistic Coefficient 0.15

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1900	1660	1447	1265	1127	1031
Energy, Ft-Lb Per Grain			8.01	6.12	4.65	3.55	2.82	2.36
Time of Flight, Seconds			0.0000	0.0845	0.1814	0.2924	0.4184	0.5579
Bullet Path	Z	50 YDS	-1.5	0.0	-1.7	-7 5	-18.8	-36.9
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-5.0	-15.5	-32.7
Line of Sight	O	150 YDS	-1.5	2.5	3.3	0.0	-8.8	-24.4
Velocity, FPS			1800	1570	1369	1204	1084	1000
Energy, Ft-Lb Per Grain			7.19	5.47	4.16	3.22	2.61	2.22
Time of Flight, Seconds			0.0000	0.0893	0.1917	0.3088	0.4405	0.5849
Bullet Path	Z	50 YDS	-1.5	0.0	-2.0	-8.8	-21.5	-41.5
(Inches) +/-	E R	100 YDS	-1.5	1.0	0.0	-5.7	-17.4	-36.4
Line of Sight	O	150 YDS	-1.5	2.9	3.8	0.0	-9.8	-27.0
Velocity, FPS			1700	1482	1294	1148	1045	972
Energy, Ft-Lb Per Grain			6.42	4.88	3.72	2.93	2.42	2.10
Time of Flight, Seconds			0.0000	0.0946	0.2031	0.3265	0.4638	0.6129
Bullet Path	Z	50 YDS	-1.5	0.0	-2.5	-10.2	-24.4	-46.7
(Inches) +/-	E R	100 YDS	-1.5	1.2	0.0	-6.4	-19.5	-40.5
Line of Sight	O	150 YDS	-1.5	3.4	4.3	0.0	-10.9	-29.7
Velocity, FPS			1600	1394	1224	1097	1010	946
Energy, Ft-Lb Per Grain			5.68	4.31	3.33	2.67	2.26	1.99
Time of Flight, Seconds			0.0000	0.1005	0.2156	0.3454	0.4882	0.6418
Bullet Path	Z	50 YDS	-1.5	0.0	-3.0	-11.8	-27.8	-52.3
(Inches) +/-	E R	100 YDS	-1.5	1.5	0.0	-7 3	-21.8	-44.8
Line of Sight	O	150 YDS	-1.5	3.9	4.9	0.0	-12.1	-32.7
Velocity, FPS			1500	1309	1159	1053	978	921
Energy, Ft-Lb Per Grain			5.00	3.80	2.98	2.46	2.12	1.88
Time of Flight, Seconds			0.0000	0.1072	0.2292	0.3654	0.5135	0.6718
Bullet Path	Z	50 YDS	-1.5	0.0	-3.6	-13.6	-31.5	-58.5
(Inches) + /-	E R	100 YDS	-1.5	1.8	0.0	-8.3	-24.3	-49.5
Line of Sight	O	150 YDS	-1.5	4.5	5.5	0.0	-13.3	-35.7
Velocity, FPS			1400	1228	1101	1012	948	896
Energy, Ft-Lb Per Grain			4.35	3.35	2.69	2.27	2.00	1.78
Time of Flight, Seconds			0.0000	0.1146	0.2440	0.3864	0.5398	0.7028
Bullet Path	Z	50 YDS	-1.5	0.0	-4.3	-15.7	-35.6	-65.2
(Inches) +/-	E R	100 YDS	-1.5	2.1	0.0	-9.3	-27.1	-54.5
Line of Sight	O	150 YDS	-1.5	5.2	6.2	0.0	-14.7	-39.0
Velocity, FPS			1300	1152	1048	974	918	870
Energy, Ft-Lb Per Grain			3.75	2.95	2.44	2.11	1.87	1.68
Time of Flight, Seconds			0.0000	0.1229	0.2598	0.4085	0.5672	0.7352
Bullet Path	Z	50 YDS	-1.5	0.0	-5.0	-18.0	-40.1	-72.5
(Inches) +/-	E R	100 YDS	-1.5	2.5	0.0	-10.4	-30.0	-59.9
Line of Sight	O	150 YDS	-1.5	6.0	6.9	0.0	-16.1	-42.5

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.15

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1200	1081	998	937	887	843
Energy, Ft-Lb Per Grain			3.20	2.59	2.21	1.95	1.75	1.58
Time of Flight, Seconds			0.0000	0.1321	0.2768	0.4320	0.5968	0.7704
Bullet Path	Z	50 YDS	-1.5	0.0	-5.9	-20.6	-45.1	-80.7
(Inches) +/-	E R	100 YDS	-1.5	3.0	0.0	-11.7	-33.2	-65.9
Line of Sight	O	150 YDS	-1.5	6.9	7.8	0.0	-17.7	-46.4
Velocity, FPS			1100	1012	947	895	851	812
Energy, Ft-Lb Per Grain			2.69	2.27	1.99	1.78	1.61	1.46
Time of Flight, Seconds			0.0000	0.1425	0.2959	0.4589	0.6309	0.8116
Bullet Path	Z	50 YDS	-1.5	0.0	-7.0	-23.6	-51.1	-90.6
(Inches) +/-	E R	100 YDS	-1.5	3.5	0.0	-13.2	-37.2	-73.2
Line of Sight	O	150 YDS	-1.5	7.9	8.8	0.0	-19.6	-51.3
Velocity, FPS			1000	938	888	844	805	770
Energy, Ft-Lb Per Grain			2.22	1.95	1.75	1.58	1.44	1.32
Time of Flight, Seconds			0.0000	0.1551	0.3196	0.4930	0.6751	0.8656
Bullet Path	Z	50 YDS	-1.5	0.0	-8.4	-27.8	-59.4	-104.4
(Inches) +/-	E R	100 YDS	-1.5	4.2	0.0	-15.2	-42.6	-83.5
Line of Sight	O	150 YDS	-1.5	9.3	10.1	0.0	-22.4	-58.1

Exterior Ballistic Table for Ballistic Coefficient 0.16

Velocity, FPS			2300	2045	1807	1590	1398	1236
Energy, Ft-Lb Per Grain			11.74	9.28	7.25	5.61	4.34	3.39
Time of Flight. Seconds			0.0000	0.0692	0.1472	0.2357	0.3364	0.4507
Bullet Path	Z	50 YDS	-1.5	0.0	-0.6	-3.9	-10.6	-21.8
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-3.0	-9.4	-20.3
Line of Sight	O	150 YDS	-1.5	1.3	2.0	0.0	-5.4	-15.3
Velocity, FPS			2200	1951	1721	1513	1332	1184
Energy, Ft-Lb Per Grain			10.75	8.45	6.58	5.08	3.94	3.11
Time of Flight, Seconds			0.0000	0.0724	0.1543	0.2473	0.3530	0.4727
Bullet Path	Z	50 YDS	-1.5	0.0	-0.8	-4.5	-12.1	-24.6
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.3	-10.5	-22.6
Line of Sight	O	150 YDS	-1.5	1.5	2.2	0.0	-6.0	-17.0
Velocity, FPS			2100	1858	1637	1438	1269	1137
Energy, Ft-Lb Per Grain			9.79	7.66	5.95	4.59	3.58	2.87
Time of Flight, Seconds			0.0000	0.0759	0.1620	0.2598	0.3710	0.4962
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-5.3	13.8	-27.8
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.8	-11.8	-25.2
Line of Sight	O	150 YDS	-1.5	1.8	2.5	0.0	-6.7	-18.9
Velocity, FPS			2000	1766	1553	1366	1210	1095
Energy, Ft-Lb Per Grain			8.88	6.92	5.35	4.14	3.25	2.66
Time of Flight, Seconds			0.0000	0.0798	0.1704	0.2735	0.3904	0.5210
Bullet Path	Z	50 YDS	-1.5	0.0	-1.3	-6.2	-15.8	-31.4
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.3	-13.2	-28.1
Line of Sight	O	150 YDS	-1.5	2.1	2.8	0.0	-7.5	-21.0

Exterior Ballistic Table for Ballistic Coefficient 0.16

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1900	1674	1472	1296	1157	1057
Energy, Ft-Lb Per Grain			8.01	6.22	4.81	3.73	2.97	2.48
Time of Flight, Seconds			0.0000	0.0841	0.1797	0.2885	0.4112	0.5472
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.6	-7.3	-18.1	-35.4
(Inches) + /-		100 YDS	-1.5	0.8	0.0	-4.8	-14.9	-31.4
Line of Sight		150 YDS	-1.5	2.4	3.2	0.0	-8.4	-23.3
Velocity, FPS			1800	1584	1392	1231	1110	1023
Energy, Ft-Lb Per Grain			7.19	5.57	4.30	3.36	2.74	2.32
Time of Flight, Seconds			0.0000	0.0889	0.1900	0.3047	0.4334	0.5744
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.0	-8.5	-20.7	-40.0
(Inches) +/-		100 YDS	-1.5	1.0	0.0	-5.5	-16.7	-35.0
Line of Sight		150 YDS	-1.5	2.8	3.7	0.0	-9.4	-25.8
Velocity, FPS			1700	1494	1316	1172	1067	993
Energy, Ft-Lb Per Grain			6.42	4.96	3.84	3.05	2.53	2.19
Time of Flight, Seconds			0.0000	0.0942	0.2013	0.3223	0.4568	0.6028
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.4	-9.9	-23.6	-45.0
(Inches) +/-		100 YDS	-1.5	1.2	0.0	-6.2	-18.8	-39.0
Line of Sight		150 YDS	-1.5	3.3	4.2	0.0	-10.5	-28.6
Velocity, FPS			1600	1406	1243	1118	1029	964
Energy, Ft-Lb Per Grain			5.68	4.39	3.43	2.77	2.35	2.06
Time of Flight, Seconds			0.0000	0.1001	0.2137	0.3413	0.4815	0.6323
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.9	-11.5	-27.0	-50.6
(Inches) +/-		100 YDS	-1.5	1.5	0.0	-7.1	-21.1	-43.4
Line of Sight		150 YDS	-1.5	3.8	4.7	0.0	-11.7	-31.5
Velocity, FPS			1500	1320	1175	1070	995	937
Energy, Ft-Lb Per Grain			5.00	3.87	3.07	2.54	2.20	1.95
Time of Flight, Seconds			0.0000	0.1067	0.2274	0.3615	0.5072	0.6627
Bullet Path	ZERO	50 YDS	-1.5	0.0	-3.5	-13.3	-30.7	-56.8
(Inches) + /-		100 YDS	-1.5	1.7	0.0	-8.0	-23.7	-48.1
Line of Sight		150 YDS	-1.5	4.4	5.4	0.0	-12.9	-34.7
Velocity, FPS			1400	1238	1114	1027	962	911
Energy, Ft-Lb Per Grain			4.35	3.40	2.76	2.34	2.05	1.84
Time of Flight, Seconds			0.0000	0.1141	0.2422	0.3827	0.5339	0.6942
Bullet Path	ZERO	50 YDS	-1.5	0.0	-4.2	-15.3	-34.8	-63.5
(Inches) +/-		100 YDS	-1.5	2.1	0.0	-9.1	-26.4	-53.1
Line of Sight		150 YDS	-1.5	5.1	6.1	0.0	-14.3	-38.0
Velocity, FPS			1300	1160	1059	987	931	884
Energy, Ft-Lb Per Grain			3.75	2.99	2.49	2.16	1.92	1.73
Time of Flight, Seconds			0.0000	0.1224	0.2581	0.4051	0.5618	0.7272
Bullet Path	ZERO	50 YDS	-1.5	0.0	-5.0	-17.6	-39.3	-70.9
Inches) +/-		100 YDS	-1.5	-2.5	0.0	-10.2	-29.4	-58.5
Line of Sight		150 YDS	-1.5	5.9	6.8	0.0	-15.7	-41.5

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.16

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1200	1087	1007	947	898	856
Energy, Ft-Lb Per Grain			3.20	2.62	2.25	1.99	1.79	1.63
Time of Flight, Seconds			0.00000	0.1317	0.2753	0.4290	0.5918	0.7629
Bullet Path	Z	50 YDS	-1.5	0.0	-5.8	-20.2	-44.3	-79.2
(Inches) +/-	E R	100 YDS	-1.5	2.9	0.0	-11.5	-32.6	-64.6
Line of Sight	O	150 YDS	-1.5	6.7	7.6	0.0	-17.3	-45.4
Velocity, FPS			1100	1017	954	904	861	823
Energy, Ft-Lb Per Grain			2.69	2.30	2.02	1.81	1.65	1.50
Time of Flight, Seconds			0.0000	0.1421	0.2946	0.4561	0.6262	0.8045
Bullet Path	Z	50 YDS	-1.5	0.0	-6.9	-23.3	-50.4	-89.2
(Inches) +/-	E R	100 YDS	-1.5	3.4	0.0	-13.0	-36.6	-71.9
Line of Sight	O	150 YDS	-1.5	7.8	8.7	0.0	-19.3	-50.3
Velocity, FPS			1000	941	893	852	815	781
Energy, Ft-Lb Per Grain			2.22	1.97	1.77	1.61	1.47	1.35
Time of Flight, Seconds			0.0000	0.1548	0.3184	0.4905	0.6706	0.8589
Bullet Path	Z	50 YDS	-1.5	0.0	-8.3	-27.5	-58.7	-102.9
(Inches) +/-	E R	100 YDS	-1.5	4.1	0.0	-15.0	-42.1	-82.2
Line of Sight	O	150 YDS	-1.5	9.2	10.0	0.0	-22 0	-57.1

Exterior Ballistic Table for Ballistic Coefficient 0.17

Velocity, FPS			2900	2625	2366	2121	1892	1680
Energy, Ft-Lb Per Grain			18.67	15.30	12.43	9.99	7.95	6.27
Time of Flight, Seconds			0.0000	0.0544	0.1146	0.1815	0.2564	0.3406
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.1	-4.4	-10.1
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.4	-4.8	-10.6
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-2.9	-8.2
Velocity, FPS			2800	2531	2277	2038	1814	1609
Energy, Ft-Lb Per Grain			17.41	14.22	11.51	9.22	7.31	5.75
Time of Flight, Seconds			0.0000	0.0564	0.1188	0.1885	0.2665	0.3544
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.4	-5.1	-11.4
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.6	-5.3	-11.7
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.2	-9.0
Velocity, FPS			2700	2437	2188	1954	1737	1539
Energy, Ft-Lb Per Grain			16.18	13.18	10.63	8.48	6.70	5.26
Time of Flight, Seconds			0.0000	0.0585	0.1235	0.1960	0.2774	0.3692
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.8	-5.8	-12.8
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-5.9	-12.9
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.5	-9.9
Velocity, FPS			2600	2342	2099	1871	1661	1471
Energy, Ft-Lb Per Grain			15.01	12.18	9.78	7.77	6.12	4.80
Time of Flight, Seconds			0.0000	0.0608	0.1284	0.2041	0.2892	0.3853
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.2	-6.7	-14.5
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-2.0	-6.5	-14.2
Line of Sight	O	150 YDS	-1.5	0.7	1.4	0.0	-3.8	-10.9

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2500	2248	2010	1789	1586	1404
Energy, Ft-Lb Per Grain			13.88	11.22	8.97	7.11	5.58	4.38
Time of Flight, Seconds			0.0000	0.0633	0.1338	0.2130	0.3021	0.4026
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.2	-2.6	-7.7	-16.3
(Inches) +/-		100 YDS	-1.5	0.1	0.0	-2.3	-7.3	-15.8
Line of Sight		150 YDS	-1.5	0.9	1.5	0.0	-4.2	-12.0
Velocity, FPS			2400	2154	1922	1707	1512	1341
Energy, Ft-Lb Per Grain			12.79	10.30	8.20	6.47	5.08	3.99
Time of Flight, Seconds			0.0000	0.0660	0.1397	0.2225	0.3159	0.4214
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.4	-3.1	-8.9	-18.4
(Inches) +/-		100 YDS	-1.5	0.2	0.0	-2.6	-8.1	-17.5
Line of Sight		150 YDS	-1.5	1.0	1.7	0.0	-4.7	-13.2
Velocity, FPS			2300	2059	1834	1627	1441	1280
Energy, Ft-Lb Per Grain			11.74	9.41	7.47	5.88	4.61	3.64
Time of Flight, Seconds			0.0000	0.0689	0.1461	0.2330	0.3310	0.4416
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.6	-3.7	-10.2	-20.8
(Inches) +/-		100 YDS	-1.5	0.3	0.0	-2.9	-9.0	-19.4
Line of Sight		150 YDS	-1.5	1.2	1.9	0.0	-5.2	-14.6
Velocity, FPS			2200	1966	1747	1548	1372	1223
Energy, Ft-Lb Per Grain			10.75	8.58	6.78	5.32	4.18	3.32
Time of Flight, Seconds			0.0000	0.0721	0.1531	0.2443	0.3473	0.4633
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.8	-4.4	-11.6	-23.5
(Inches) +/-		100 YDS	-1.5	0.4	0.0	-3.2	-10.1	-21.6
Line of Sight		150 YDS	-1.5	1.5	2.2	0.0	-5.8	-16.2
Velocity, FPS			2100	1872	1662	1471	1306	1171
Energy, Ft-Lb Per Grain			9.79	7.78	6.13	4.80	3.79	3.04
Time of Flight, Seconds			0.0000	0.0757	0.1607	0.2567	0.3651	0.4866
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.0	-5.1	-13.3	-26.6
Inches) +/-		100 YDS	-1.5	0.5	0.0	-3.7	-11.3	-24.1
Line of Sight		150 YDS	-1.5	1.7	2.4	0.0	-6 5	-18.1
Velocity, FPS			2000	1779	1577	1397	1244	1125
Energy, Ft-Lb Per Grain			8.88	7.03	5.52	4.33	3.44	2.81
Time of Flight, Seconds			0.0000	0.0795	0.1691	0.2703	0.3842	0.5113
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.3	-6.0	-15.3	-30.1
(Inches) +/-		100 YDS	-1.5	0.6	0.0	-4.1	-12.8	-27.0
Line of Sight		150 YDS	-1.5	2.0	2.8	0.0	-7.2	-20.1
Velocity, FPS			1900	1687	1494	1325	1186	1083
Energy, Ft-Lb Per Grain			8.01	6.32	4.96	3.90	3.12	2.60
Time of Flight, Seconds			0.0000	0.0838	0.1783	0.2850	0.4049	0.5375
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.6	-7.0	-17.5	-34.1
(Inches) +/-		100 YDS	-1.5	0.8	0.0	-4.7	-14.3	-30.2
Line of Sight		150 YDS	-1.5	2.3	3.1	0.0	-8.1	-22.4

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE	ZERO	MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1800	1596	1413	1257	1135	1046
Energy, Ft-Lb Per Grain		7.19	5.65	4.43	3.51	2.86	2.43
Time of Flight, Seconds		0.0000	0.0885	0.1885	0.3012	0.4270	0.5650
Bullet Path	50 YDS	-1.5	0.0	-1.9	-8.2	-20 0	-38.6
(Inches) +/-	100 YDS	-1.5	1.0	0.0	-5.3	-16.2	-33.8
Line of Sight	150 YDS	-1.5	2.7	3.6	0.0	-9.1	-24.9
Velocity, FPS		1700	1506	1335	1194	1088	1012
Energy, Ft-Lb Per Grain		6.42	5.04	3.96	3.17	2.63	2.27
Time of Flight, Seconds		0.0000	0.0938	0.1997	0.3187	0.4506	0.5937
Bullet Path	50 YDS	-1.5	0.0	-2.3	-9.6	-22.9	-43.6
(Inches) +/-	100 YDS	-1.5	1.2	0.0	-6.1	-18.2	-37.7
Line of Sight	150 YDS	-1.5	3.2	4.0	0.0	-10.1	-27.6
Velocity, FPS		1600	1417	1260	1137	1047	982
Energy, Ft-Lb Per Grain		5.68	4.46	3.52	2.87	2.43	2.14
Time of Flight, Seconds		0.0000	0.0997	0.2121	0.3377	0.4754	0.6236
Bullet Path	50 YDS	-1.5	0.0	-2.8	-11.2	-26.2	-49.2
(Inches) +/-	100 YDS	-1.5	1.4	0.0	-6.9	-20.5	-42.1
Line of Sight	150 YDS	-1.5	3.7	4.6	0.0	-11.3	-30.5
Velocity, FPS		1500	1330	1190	1086	1010	953
Energy, Ft-Lb Per Grain		5.00	3.93	3.14	2.62	2.26	2.02
Time of Flight, Seconds		0.0000	0.1063	0.2257	0.3580	0.5014	0.6545
Bullet Path	50 YDS	-1.5	0.0	-3.4	-13.0	-29.9	-55.3
(Inches) +/-	100 YDS	-1.5	1.7	0.0	-7.8	-23.1	-46.8
Line of Sight	150 YDS	-1.5	4.3	5.2	0.0	-12.6	-33.7
Velocity, FPS		1400	1246	1126	1040	976	925
Energy, Ft-Lb Per Grain		4.35	3.45	2 81	2.40	2.11	1.90
Time of Flight, Seconds		0.0000	0.1137	0.2406	0.3794	0.5285	0.6865
Bullet Path	50 YDS	-1.5	0.0	-4.1	-15.0	-34.0	-62.1
(Inches) +/-	100 YDS	-1.5	2.1	0.0	-8.9	-25.8	-51.8
Line of Sight	150 YDS	-1.5	5.0	5.9	0.0	-14.0	-37.0
Velocity, FPS		1300	1167	1069	998	943	897
Energy, Ft-Lb Per Grain		3.75	3.02	2.54	2.21	1.97	1.79
Time of Flight, Seconds		0.0000	0.1220	0 2566	0.4021	0.5569	0.7200
Bullet Path	50 YDS	-1.5	0.0	-4.9	-17.3	-38.5	-69.5
(Inches) +/-	100 YDS	-1.5	2.4	0.0	-10.0	-28.8	-57.3
Line of Sight	150 YDS	-1.5	5.8	6.7	0.0	-15.4	-40.6
Velocity, FPS		1200	1093	1015	957	909	868
Energy, Ft-Lb Per Grain		3.20	2.65	2.29	2.03	1.83	1.67
Time of Flight, Seconds		0.0000	0.1313	0.2739	0.4263	0.5872	0.7562
Bullet Path	50 YDS	-1.5	0.0	-5.8	-20.0	-43.6	-77.8
(Inches) +/-	100 YDS	-1.5	2.9	0.0	-11.3	-32.1	-63.4
Line of Sight	150 YDS	-1.5	6.7	7.5	0.0	-17.0	-44.6

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1100	1021	961	913	871	834
Energy, Ft-Lb Per Grain			2.69	2.31	2.05	1.85	1.68	1.54
Time of Flight, Seconds			0.0000	0.1418	0.2934	0.4537	0.6220	0.7981
Bullet Path	Z	50 YDS	-1.5	0.0	-6.8	-23.1	-49.7	-87.9
(Inches) +/-	E R	100 YDS	-1.5	3.4	0.0	-12.8	-36.1	-70.8
Line of Sight	O	150 YDS	-1.5	7.7	8.5	0.0	-19.0	-49.4
Velocity, FPS			1000	945	899	859	823	791
Energy, Ft-Lb Per Grain			2.22	1.98	1.79	1.64	1.50	1.39
Time of Flight, Seconds			0.0000	0.1545	0.3174	0.4883	0.6667	0.8528
Bullet Path	Z	50 YDS	-1.5	0.0	-8.2	-27.2	-58.0	-101.6
(Inches) +/-	E R	100 YDS	-1.5	4.1	0.0	-14.9	-41.5	-81.0
Line of Sight	O	150 YDS	-1.5	9.1	9.9	0.0	-21.7	-56.2

Exterior Ballistic Table for Ballistic Coefficient 0.18

Velocity, FPS			2800	2545	2304	2077	1862	1664
Energy, Ft-Lb Per Grain			17.41	14.38	11.79	9.58	7.70	6.15
Time of Flight, Seconds			0.0000	0.0562	0.1181	0.1867	0.2630	0.3482
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.3	-4.8	-10.9
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.6	-5.2	-11.3
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-3.1	-8.7
Velocity. FPS			2700	2451	2215	1992	1784	1592
Energy, Ft-Lb Per Grain			16.18	13.34	10.89	8.81	7.07	5.63
Time of Flight, Seconds			0.0000	0.0583	0.1227	0.1941	0.2737	0.3627
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.7	-5.6	-12.3
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-5.7	-12.4
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.4	-9.5
Velocity, FPS			2600	2356	2125	1908	1706	1521
Energy, Ft-Lb Per Grain			15.01	12.32	10.02	8.08	6.46	5.14
Time of Flight, Seconds			0.0000	0.0606	0.1276	0.2021	0.2853	0.3784
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.1	-6.5	-13.9
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-2.0	-6.3	-13.7
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.7	-10.4
Velocity, FPS			2500	2261	2036	1825	1629	1452
Energy, Ft-Lb Per Grain			13.88	11.35	9.20	7.39	5.89	4.68
Time of Flight, Seconds			0.0000	0.0631	0.1330	0.2108	0.2979	0.3954
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.5	-7.5	-15.7
Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.2	-7.0	-15.2
Line of Sight	O	150 YDS	-1.5	0.8	1.5	0.0	-4.1	-11.5
Velocity, FPS			2400	2167	1947	1742	1554	1386
Energy, Ft-Lb Per Grain			12.79	10.43	8.42	6.74	5.36	4.26
Time of Flight, Seconds			0.0000	0.0658	0.1388	0.2203	0.3115	0.4138
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-3.0	-8.6	-17.7
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.5	-7.8	-16.8
Line of Sight	O	150 YDS	-1.5	1.0	1.7	0.0	-4.5	-12.7

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.18

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2300	2072	1859	1660	1480	1322
Energy, Ft-Lb Per Grain			11.74	9.53	7.67	6.12	4.86	3.88
Time of Flight, Seconds			0.0000	0.0687	0.1452	0.2306	0.3263	0.4336
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.5	-3.6	-9.8	-20.0
(Inches) +/-		100 YDS	-1.5	0.3	0.0	-2.8	-8.8	-18.7
Line of Sight		150 YDS	-1.5	1.2	1.9	0.0	-5.0	-14.0
Velocity, FPS			2200	1978	1771	1580	1409	1261
Energy, Ft-Lb Per Grain			10.75	8.69	6.96	5.54	4.41	3.53
Time of Flight, Seconds			0.0000	0.0719	0.1521	0.2418	0.3424	0.4551
Bullet Path	ZERO	50 YDS	-1.5	0.0	-0.7	-4.2	-11.3	-22.7
(Inches) +/-		100 YDS	-1.5	0.4	0.0	-3.1	-9.8	-20.8
Line of Sight		150 YDS	-1.5	1.4	2.1	0.0	-5.6	-15.6
Velocity, FPS			2100	1884	1684	1502	1340	1205
Energy, Ft-Lb Per Grain			9.79	7.88	6.30	5.01	3.99	3.22
Time of Flight, Seconds			0.0000	0.0754	0.1596	0.2540	0.3598	0.4781
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.0	-5.0	-12.9	-25.7
(Inches) +/-		100 YDS	-1.5	0.5	0.0	-3.6	-11.0	-23.3
Line of Sight		150 YDS	-1.5	1.7	2.4	0.0	-6.2	-17.3
Velocity, FPS			2000	1791	1599	1425	1275	1154
Energy, Ft-Lb Per Grain			8.88	7.12	5.68	4.51	3.61	2.96
Time of Flight, Seconds			0.0000	0.0793	0.1679	0.2674	0.3788	0.5027
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.2	-5.9	-14.8	-29.1
(Inches) +/-		100 YDS	-1.5	0.6	0.0	-4.0	-12.3	-26.0
Line of Sight		150 YDS	-1.5	2.0	2.7	0.0	-7.0	-19.3
Velocity, FPS			1900	1698	1515	1351	1214	1108
Energy, Ft-Lb Per Grain			8.01	6.40	5.10	4.05	3.27	2.73
Time of Flight, Seconds			0.0000	0.0835	0.1771	0.2820	0.3993	0.5289
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.5	-6.9	-17.0	-33.0
(Inches) +/-		100 YDS	-1.5	0.8	0.0	-4.6	-13.9	-29.1
Line of Sight		150 YDS	-1.5	2.3	3.0	0.0	-7.8	-21.5
Velocity, FPS			1800	1607	1432	1281	1159	1068
Energy, Ft-Lb Per Grain			7.19	5.73	4.55	3.64	2.98	2.53
Time of Flight, Seconds			0.0000	0.0882	0.1872	0.2980	0.4214	0.5565
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.9	-8.0	-19.4	-37.3
(Inches) +/-		100 YDS	-1.5	0.9	0.0	-5.2	-15.7	-32.6
Line of Sight		150 YDS	-1.5	2.7	3.5	0.0	-8.8	-24.0
Velocity, FPS			1700	1516	1353	1215	1109	1031
Energy, Ft-Lb Per Grain			6.42	5.10	4.06	3.28	2.73	2.36
Time of Flight, Seconds			0.0000	0.0935	0.1983	0.3155	0.4450	0.5855
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.3	-9.4	-22.3	-42.3
(Inches) +/-		100 YDS	-1.5	1.1	0.0	-5.9	-17.7	-36.6
Line of Sight		150 YDS	-1.5	3.1	3.9	0.0	-9.8	-26.7

Exterior Ballistic Table for Ballistic Coefficient 0.18

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1600	1426	1276	1155	1065	998
Energy, Ft-Lb Per Grain		5.68	4.51	3.61	2.96	2.52	2.21
Time of Flight, Seconds		0.0000	0.0993	0.2107	0.3344	0.4700	0.6157
Bullet Path	Z 50 YDS	-1.5	0.0	-2.8	-10.9	-25.6	-47.9
(Inches) +/-	E R 100 YDS	-1.5	1.4	0.0	-6.7	-20.0	-40.9
Line of Sight	O 150 YDS	-1.5	3.6	4.5	0.0	-11.0	-29.7
Velocity, FPS		1500	1339	1204	1101	1025	968
Energy, Ft-Lb Per Grain		5.00	3.98	3.22	2.69	2.33	2.08
Time of Flight, Seconds		0.0000	0.1059	0.2243	0.3548	0.4963	0.6471
Bullet Path	Z 50 YDS	-1.5	0.0	-3.4	-12.7	-29.2	-54.0
(Inches) +/-	E R 100 YDS	-1.5	1.7	0.0	-7.7	-22.5	-45.6
Line of Sight	O 150 YDS	-1.5	4.2	5.1	0.0	-12.3	-32.8
Velocity, FPS		1400	1254	1138	1053	989	938
Energy, Ft-Lb Per Grain		4.35	3.49	2.88	2.46	2.17	1.95
Time of Flight, Seconds		0.0000	0.1133	0.2391	0.3765	0.5237	0.6796
Bullet Path	Z 50 YDS	-1.5	0.0	-4.0	-14.8	-33.3	-60.8
(Inches) +/-	E R 100 YDS	-1.5	2.0	0.0	-8.7	-25.3	-50.7
Line of Sight	O 150 YDS	-1.5	4.9	5.8	0.0	-13.6	-36.2
Velocitv, FPS		1300	1173	1078	1008	954	909
Energy, Ft-Lb Per Grain		3.75	3.05	2.58	2.26	2.02	1.83
Time of Flight, Seconds		0.0000	0.1217	0.2553	0.3993	0.5524	0.7136
Bullet Path	Z 50 YDS	-1.5	0.0	-4.8	-17.1	-37 9	-68.3
(Inches) +/-	E R 100 YDS	-1.5	2.4	0.0	-9.9	-28.3	-56.2
Line of Sight	O 150 YDS	-1.5	5.7	6.6	0.0	-15.1	-39.8
Velocity, FPS		1200	1098	1023	966	919	879
Energy, Ft-Lb Per Grain		3.20	2.68	2.32	2.07	1.87	1.72
Time of Flight, Seconds		0.0000	0.1310	0.2727	0.4238	0.5931	0.7501
Bullet Path	Z 50 YDS	-1.5	0.0	-5.7	-19.7	-43.0	-76.6
(Inches) +/-	E R 100 YDS	-1.5	2.9	0.0	-11.1	-31.6	-62.3
Line of Sight	O 150 YDS	-1.5	6.6	7.4	0.0	-16.7	-43.8
Velocity, FPS		1100	1025	967	920	880	844
Energy, Ft-Lb Per Grain		2.69	2.33	2.08	1.88	1.72	1.58
Time of Flight, Seconds		0.0000	0.1415	0.2924	0.4515	0.6183	0.7925
Bullet Path	Z 50 YDS	-1.5	0.0	-6.8	-22.8	-49.1	-86.7
(Inches) +/-	E R 100 YDS	-1.5	3.4	0.0	-12.7	-35.6	-69.8
Line of Sight	O 150 YDS	-1.5	7.6	8.4	0.0	-18.7	-48.6
Velocity, FPS		1000	947	903	865	831	799
Energy, Ft-Lb Per Grain		2.22	1.99	1.81	1.66	1.53	1.42
Time of Flight, Seconds		0.0000	0.1542	0.3165	0.4863	0.6633	0.8474
Bullet Path	Z 50 YDS	-1.5	0.0	-8.2	-27.0	-57.5	-100.5
(Inches) + /-	E R 100 YDS	-1.5	4.1	0.0	-14.7	-41.1	-80.0
Line of Sight	O 150 YDS	-1.5	9.0	9.8	0.0	-21.4	-55.5

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2900	2653	2419	2197	1986	1789
Energy, Ft-Lb Per Grain			18.67	15.63	12.99	10.72	8.76	7.11
Time of Flight, Seconds			0.0000	0.0541	0.1133	0.1784	0.2502	0.3298
Bullet Path	Z	50 YDS	-1.5	0.0	0.3	-1.0	-4.0	-9.2
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.4	-4.5	-9.9
Line of Sight	O	150 YDS	-1.5	0.3	0.9	0.0	-2.7	-7.6
Velocity, FPS			2800	2558	2329	2112	1906	1714
Energy, Ft-Lb Per Grain			17.41	14.53	12.04	9.90	8.07	6.52
Time of Flight, Seconds			0.0000	0.0560	0.1175	0.1851	0.2599	0.3429
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.3	-4.7	-10.5
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-1.5	-5.0	-10 9
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-3.0	-8 3
Velocity, FPS			2700	2464	2239	2026	1826	1641
Energy, Ft-Lb Per Grain			16.18	13.48	11.13	9.11	7.40	5.98
Time of Flight, Seconds			0.0000	0.0582	0.1220	0.1925	0.2704	0.3571
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.6	-5.4	-11.8
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.7	-5.5	-12.0
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.3	-9.1
Velocity, FPS			2600	2369	2149	1941	1747	1568
Energy, Ft-Lb Per Grain			15.01	12.46	10.25	8.36	6.78	5.46
Time of Flight, Seconds			0.0000	0.0604	0.1269	0.2004	0.2818	0.3725
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.0	-6.3	-13.4
(Inches) +/-	E R	100 YDS	-1.5	0.0	-1.9	-6.1	0.0	-13.2
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.6	-10.0
Velocity, FPS			2500	2274	2059	1857	1669	1497
Energy, Ft-Lb Per Grain			13.88	11.48	9.41	7.66	6.18	4.98
Time of Flight, Seconds			0.0000	0.0629	0.1322	0.2090	0.2942	0.3891
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.4	-7.2	-15.1
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.2	-6.8	-14.6
Line of Sight	O	150 YDS	-1.5	0.8	1.4	0.0	-4.0	-11.1
Velocity, FPS			2400	2179	1969	1773	1592	1428
Energy, Ft-Lb Per Grain			12.79	10.54	8.61	6.98	5.63	4.53
Time of Flight, Seconds			0.0000	0.0656	0.1380	0.2183	0.3076	0.4072
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-2.9	-8.3	-17.1
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.4	-7.6	-16.2
Line of Sight	O	150 YDS	-1.5	1 0	1.6	0.0	-4.4	-12.2
Velocity, FPS			2300	2084	1880	1690	1516	1361
Energy, Ft-Lb Per Grain			11.74	9.64	7.85	6.34	5.10	4.11
Time of Flight, Seconds			0.0000	0.0685	0.1443	0.2285	0.3222	0.4267
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.5	-9.5	-19.3
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.7	-8.5	-18.1
Line of Sight	O	150 YDS	-1.5	1.2	1.8	0.0	-4.9	-13.5

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2200	1990	1792	1609	1443	1297
Energy, Ft-Lb Per Grain			10.75	8.79	7.13	5.75	4.62	3.73
Time of Flight, Seconds			0.0000	0.0717	0.1512	0.2395	0.3380	0.4478
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-4.1	-10.9	-21.9
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.1	-9.5	-20.1
Line of Sight	O	150 YDS	-1.5	1.4	2.0	0.0	-5.4	-15.0
Velocity, FPS			2100	1895	1704	1529	1372	1238
Energy, Ft-Lb Per Grain			9.79	7.97	6.45	5.19	4.18	3.40
Time of Flight, Seconds			0.0000	0.0752	0.1587	0.2516	0.3553	0.4705
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-4.9	-12.5	-24.8
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.5	-10.7	-22.5
Line of Sight	O	150 YDS	-1.5	1.6	2.3	0.0	-6.0	-16.7
Velocity, FPS			2000	1802	1618	1451	1304	1183
Energy, Ft-Lb Per Grain			8.88	7.21	5.81	4.67	3.78	3.11
Time of Flight, Seconds			0.0000	0.0790	0.1669	0.2649	0.3740	0.4949
Bullet Path	Z	50 YDS	-1.5	0.0	-1.2	-5.7	-14.4	-28.1
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.9	-12.0	-25.2
Line of Sight	O	150 YDS	-1.5	1.9	2.6	0.0	-6.8	-18.6
Velocity, FPS			1900	1709	1533	1376	1241	1133
Energy, Ft-Lb Per Grain			8.01	6.48	5.22	4.20	3.42	2.85
Time of Flight, Seconds			0.0000	0.0833	0.1760	0.2794	0.3943	0.5211
Bullet Path	Z	50 YDS	-1.5	0.0	-1.5	-6.7	-16.5	-31.9
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.5	-13.5	-28.2
Line of Sight	O	150 YDS	-1.5	2.2	3.0	0.0	-7.6	-20.8
Velocity, FPS			1800	1616	1450	1303	1182	1089
Energy, Ft-Lb Per Grain			7.19	5.80	4.67	3.77	3.10	2.63
Time of Flight, Seconds			0.0000	0.0880	0.1860	0.2952	0.4163	0.5488
Bullet Path	Z	50 YDS	-1.5	0.0	-1.8	-7.8	-18.9	-36.3
(Inches) + /-	E R	100 YDS	-1.5	0.9	0.0	-5.1	-15.3	-31.7
Line of Sight	O	150 YDS	-1.5	2.6	3.4	0.0	-8 5	-23.2
Velocity, FPS			1700	1525	1369	1235	1129	1050
Energy, Ft-Lb Per Grain			6.42	5.16	4.16	3.39	2.83	2.45
Time of Flight, Seconds			0.0000	0.0932	0.1971	0.3126	0.4399	0.5779
Bullet Path	Z	50 YDS	-1.5	0.0	-2.2	-9.1	-21.8	-41.2
(Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-5.8	-17.3	-35.5
Line of Sight	O	150 YDS	-1.5	3.0	3.9	0.0	-9.6	-25.9
Velocity, FPS			1600	1435	1291	1172	1081	1014
Energy, Ft-Lb Per Grain			5.68	4.57	3.70	3.05	2.59	2.28
Time of Flight, Seconds			0.0000	0.0990	0.2094	0.3315	0.4650	0.6085
Bullet Path	Z	50 YDS	-1.5	0.0	-2.7	-10.7	-25.0	-46.7
(Inches) +/-	E R	100 YDS	-1.5	1.4	0.0	-6.6	-19.5	-39.9
Line of Sight	O	150 YDS	-1.5	3.6	4.4	0.0	-10.7	-28.9

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1500	1347	1217	1115	1039	981
Energy, Ft-Lb Per Grain			5.00	4.03	3.29	2.76	2.40	2.14
Time of Flight, Seconds			0.0000	0.1056	0.2230	0.3520	0.4915	0.6402
Bullet Path	ZERO	50 YDS	-1.5	0.0	-3.3	-12.5	-28.6	-52.8
(Inches) +/-		100 YDS	-1.5	1.7	0.0	-7.5	-22.0	-44.6
Line of Sight		150 YDS	-1.5	4.2	5.0	0.0	-12.0	-32.0
Velocity, FPS			1400	1261	1149	1064	1001	951
Energy, Ft-Lb Per Grain			4.35	3.53	2.93	2.51	2.22	2.01
Time of Flight, Seconds			0.0000	0.1130	0.2379	0.3738	0.5193	0.6732
Bullet Path	ZERO	50 YDS	-1.5	0.0	-4.0	-14.5	-32.7	-59.6
(Inches) +/-		100 YDS	-1.5	2.0	0.0	-8.6	-24.8	-49.7
Line of Sight		150 YDS	-1.5	4.8	5.7	0.0	-13.4	-35.4
Velocity, FPS			1300	1179	1087	1018	965	920
Energy, Ft-Lb Per Grain			3.75	3.09	2.62	2.30	2.07	1.88
Time of Flight, Seconds			0.0000	0.1213	0.2540	0.3968	0.5483	0.7077
Bullet Path	ZERO	50 YDS	-1.5	0.0	-4.7	-16.8	-37.3	-67.1
Inches) +/-		100 YDS	-1.5	2.4	0.0	-9.7	-27.8	-55.2
Line of Sight		150 YDS	-1.5	5.6	6.5	0.0	-14.9	-39.1
Velocity, FPS			1200	1102	1030	974	928	889
Energy, Ft-Lb Per Grain			3.20	2.70	2.36	2.11	1.91	1.75
Time of Flight, Seconds			0.0000	0.1307	0.2716	0.4216	0.5794	0.7447
Bullet Path	ZERO	50 YDS	-1.5	0.0	-5.6	-19.5	-42.5	-75.5
(Inches) + /-		100 YDS	-1.5	2.8	0.0	-11.0	-31.2	-61.4
Line of Sight		150 YDS	-1.5	6.5	7.3	0.0	-16.5	-43.1
Velocity, FPS			1100	1028	972	927	888	853
Energy, Ft-Lb Per Grain			2.69	2.35	2.10	1.91	1.75	1.62
Time of Flight, Seconds			0.0000	0.1413	0.2914	0.4495	0.6150	0.7875
Bullet Path	ZERO	50 YDS	-1.5	0.0	-6.7	-22.6	-48.6	-85.7
(Inches) +/-		100 YDS	-1.5	3.4	0.0	-12.5	-35.2	-68.9
Line of Sight		150 YDS	-1.5	7.5	8.4	0.0	-18.5	-48.0
Velocity, FPS			1000	950	908	871	838	807
Energy, Ft-Lb Per Grain			2.22	2.00	1.83	1.68	1.56	1.45
Time of Flight, Seconds			0.0000	0.1540	0.3157	0.4844	0.6602	0.8426
Bullet Path	ZERO	50 YDS	-1.5	0.0	-8.1	-26.8	-56.9	-99.4
(Inches) +/-		100 YDS	-1.5	4.1	0.0	-14.6	-40.7	-79.1
Line of Sight		150 YDS	-1.5	8.9	9.7	0.0	-21.2	-54.8

Exterior Ballistic Table for Ballistic Coefficient 0.21

Velocity, FPS			2900	2676	2463	2259	2065	1881
Energy, Ft-Lb Per Grain			18.67	15.90	13.47	11.33	9.47	7.85
Time of Flight, Seconds			0.0000	0.0539	0.1123	0.1759	0.2453	0.3214
Bullet Path	ZERO	50 YDS	-1.5	0.0	0.3	-0.9	-3.7	-8.6
(Inches) +/-		100 YDS	-1.5	-0.1	0.0	-1.3	-4.3	-9.3
Line of Sight		150 YDS	-1.5	0.3	0.9	0.0	-2.6	-7.2

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2800	2581	2372	2173	1983	1804
Energy, Ft-Lb Per Grain			17.41	14.79	12.49	10.48	8.73	7.23
Time of Flight, Seconds			0.0000	0.0558	0.1164	0.1825	0.2548	0.3341
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.2	-4.4	-9.8
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.5	-4.8	-10.3
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-2.8	-7.8
Velocity, FPS			2700	2486	2281	2086	1901	1727
Energy, Ft-Lb Per Grain			16.18	13.72	11.55	9.66	8.02	6.62
Time of Flight, Seconds			0.0000	0.0579	0.1209	0.1897	0.2650	0.3478
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.5	-5.1	11 1
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.6	-5.3	-11.3
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.1	-8.6
Velocity, FPS			2600	2390	2190	2000	1819	1651
Energy, Ft-Lb Per Grain			15.01	12.68	10.65	8.88	7.35	6.05
Time of Flight, Seconds			0.0000	0.0602	0.1257	0.1974	0.2761	0.3626
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.9	-5.9	-12.5
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-5.8	-12.5
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.4	-9.4
Velocity, FPS			2500	2295	2099	1913	1739	1577
Energy, Ft-Lb Per Grain			13.88	11.69	9.78	8.12	6.71	5.52
Time of Flight, Seconds			0.0000	0.0626	0.1310	0.2058	0.2881	0.3787
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.3	-6.8	-14.2
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.1	-6.5	-13.8
Line of Sight	O	150 YDS	-1.5	0.8	1.4	0.0	-3.8	-10.4
Velocity, FPS			2400	2199	2008	1828	1659	1504
Energy, Ft-Lb Per Grain			12.79	10.74	8.95	7.42	6.11	5.02
Time of Flight, Seconds			0.0000	0.0653	0.1367	0.2150	0.3011	0.3961
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-2.8	-7.8	-16.1
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.3	-7.2	-15.3
Line of Sight	O	150 YDS	-1.5	0.9	1.5	0.0	-4.2	-11.5
Velocity, FPS			2300	2104	1918	1743	1581	1433
Energy, Ft-Lb Per Grain			11.74	9.83	8.17	6.74	5.55	4.56
Time of Flight, Seconds			0.0000	0.0682	0.1429	0.2249	0.3153	0.4150
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.3	-9.0	-18.2
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.6	-8.1	-17.0
Line of Sight	O	150 YDS	-1.5	1.1	1.7	0.0	-4.6	-12.7
Velocity, FPS			2200	2009	1828	1660	1504	1364
Energy, Ft-Lb Per Grain			10.75	8.96	7.42	6.12	5.02	4.13
Time of Flight, Seconds			0.0000	0.0714	0.1496	0.2358	0.3307	0.4355
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-3.9	-10.4	-20.6
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.9	-9.0	-19.0
Line of Sight	O	150 YDS	-1.5	1.3	2.0	0.0	-5.1	-14.1

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2100	1914	1739	1577	1430	1299
Energy, Ft-Lb Per Grain			9.79	8.13	6.71	5.52	4.54	3.75
Time of Flight, Seconds			0.0000	0.0748	0.1570	0.2476	0.3475	0.4577
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-4.6	-11.9	-23.4
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.3	-10.1	-21.2
Line of Sight	O	150 YDS	-1.5	1.5	2.2	0.0	-5.7	-15.7
Velocity, FPS			2000	1820	1652	1497	1358	1237
Energy, Ft-Lb Per Grain			8.88	7.35	6.06	4.98	4.09	3.40
Time of Flight, Seconds			0.0000	0.0786	0.1652	0.2606	0.3659	0.4818
Bullet Path	Z	50 YDS	-1.5	0.0	-1.1	-5 5	-13.7	-26.6
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.8	-11.4	-23.8
Line of Sight	O	150 YDS	-1.5	1.8	2.5	0.0	-6.4	-17.5
Velocity, FPS			1900	1726	1565	1418	1289	1181
Energy, Ft-Lb Per Grain			8.01	6.61	5.44	4.46	3.69	3.10
Time of Flight, Seconds			0.0000	0.0828	0.1741	0.2748	0.3859	0.5076
Bullet Path	Z	50 YDS	-1.5	0.0	-1.4	-6.4	-15.7	-30.3
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.3	-12.9	-26.7
Line of Sight	O	150 YDS	-1.5	2.1	2.8	0.0	-7.2	-19.6
Velocity, FPS			1800	1633	1480	1343	1225	1130
Energy, Ft-Lb Per Grain			7.19	5.92	4.86	4.00	3.33	2.83
Time of Flight, Seconds			0.0000	0.0875	0.1840	0.2905	0.4076	0.5353
Bullet Path	Z	50 YDS	-1.5	0.0	-1.8	-7.5	-18.1	-34.5
(Inches) +/-	E R	100 YDS	- 1.5	0.9	0.0	-4.9	-14.6	-30.0
Line of Sight	O	150 YDS	-1.5	2.5	3.2	0.0	-8.1	-21.9
Velocity, FPS			1700	1541	1397	1270	1166	1084
Energy, Ft-Lb Per Grain			6.42	5.27	4.33	3.58	3.02	2.61
Time of Flight, Seconds			0.0000	0.0927	0.1950	0.3077	0.4311	0.5647
Bullet Path	Z	50 YDS	-1.5	0.0	-2.2	-8.8	-20.8	-39.2
(Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-5.5	-16.5	-33.8
Line of Sight	O	150 YDS	-1.5	2.9	3.7	0.0	-9.1	-24.6
Velocity, FPS			1600	1450	1316	1203	1113	1044
Energy, Ft-Lb Per Grain			5.68	4.67	3.84	3.21	2.75	2.42
Time of Flight, Seconds			0.0000	0.0985	0.2072	0.3265	0.4564	0.5958
Bullet Path	Z	50 YDS	-1.5	0.0	-2.6	-10.3	-24.0	-44.7
(Inches) +/-	E R	100 YDS	-1.5	1.3	0.0	-6.3	-18.7	-38.1
Line of Sight	O	150 YDS	-1.5	3.4	4.2	0.0	-10.2	-27.5
Velocity, FPS			1500	1360	1239	1141	1066	1007
Energy, Ft-Lb Per Grain			5.00	4.11	3.41	2.89	2.52	2.25
Time of Flight, Seconds			0.0000	0.1051	0.2207	0.3470	0.4832	0.6282
Bullet Path	Z	50 YDS	-1.5	0.0	-3.2	-12.1	-27.6	-50.8
(Inches) +/-	E R	100 YDS	-1.5	1.6	0.0	-7.3	-21.2	-42.8
Line of Sight	O	150 YDS	-1.5	4.0	4.8	0.0	- 11.5	-30.7

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1400	1273	1168	1086	1023	973
Energy, Ft-Lb Per Grain		4.35	3.60	3.03	2.62	2.32	2.10
Time of Flight, Seconds		0.0000	0.1125	0.2356	0.3690	0.5115	0.6620
Bullet Path	Z 50 YDS	-1.5	0 0	-3.9	-14.1	-31.7	-57.6
(Inches) +/-	E R 100 YDS	-1.5	1.9	0.0	-8.3	-24.0	-47.9
Line of Sight	O 150 YDS	-1.5	4.7	5.5	0.0	-12.9	-34.1
Velocity, FPS		1300	1190	1102	1036	984	941
Energy, Ft-Lb Per Grain		3.75	3.14	2.70	2.38	2.15	1.97
Time of Flight, Seconds		0.0000	0.1208	0.2519	0.3925	0.5412	0.6973
Bullet Path	Z 50 YDS	-1.5	0.0	-4.6	-16.4	-36.3	-65.1
(Inches) +/-	E R 100 YDS	-1.5	2.3	0.0	-9.5	-27.0	-53.5
Line of Sight	O 150 YDS	-1.5	5.5	6.3	0.0	-14.4	-37.8
Velocity, FPS		1200	1110	1042	989	945	907
Energy, Ft-Lb Per Grain		3.20	2.74	2.41	2.17	1.98	1.83
Time of Flight, Seconds		0.0000	0.1301	0.2697	0.4177	0.5730	0.7351
Bullet Path	Z 50 YDS	-1.5	0.0	-5.5	-19.1	-41.5	-73.7
(Inches) +/-	E R 100 YDS	-1.5	2.8	0.0	-10.8	-30.4	-59.8
Line of Sight	O 150 YDS	-1.5	6.4	7.2	0.0	-16.1	-41.9
Velocity, FPS		1100	1034	982	939	902	869
Energy, Ft-Lb Per Grain		2.69	2.37	2.14	1.96	1.81	1.68
Time of Flight, Seconds		0.0000	0.1408	0.2898	0.4461	0.6091	0.7786
Bullet Path	Z 50 YDS	-1.5	0.0	-6.6	-22.2	-47.7	-83.9
(Inches) +/-	E R 100 YDS	-1.5	3.3	0.0	-12.3	-34.5	-67.3
Line of Sight	O 150 YDS	-1.5	7.4	8.2	0.0	-18.1	-46.8
Velocity, FPS		1000	954	915	881	850	822
Energy, Ft-Lb Per Grain		2.22	2.02	1.86	1.72	1.60	1.50
Time of Flight, Seconds		0.0000	0.1537	0.3142	0.4814	0.6548	0.8344
Bullet Path	Z 50 YDS	-1.5	0.0	-8.0	-26.5	-56.1	-97.7
(Inches) +/-	E R 100 YDS	-1.5	4.0	0.0	-14.4	-40.0	-77.6
Line of Sight	O 150 YDS	-1.5	8.8	9.6	0.0	-20.8	-53.6

Exterior Ballistic Table for Ballistic Coefficient 0.22

Velocity, FPS		2900	2686	2482	2286	2100	1922
Energy, Ft-Lb Per Grain		18.67	16.02	13.68	11.60	9.79	8.20
Time of Flight, Seconds		0.0000	0.0538	0.1119	0.1748	0.2433	0.3180
Bullet Path	Z 50 YDS	-1.5	0.0	0.3	-0.8	-3.6	-8.4
(Inches) +/-	E R 100 YDS	-1.5	-0.1	0.0	-1.3	-4.2	-9.1
Line of Sight	O 150 YDS	-1.5	0.3	0.8	0.0	-2.5	-7.0
Velocity, FPS		2800	2591	2390	2199	2017	1844
Energy, Ft-Lb Per Grain		17.41	14.90	12.68	10.74	9.03	7.55
Time of Flight, Seconds		0.0000	0.0557	0.1160	0.1814	0.2526	0.3304
Bullet Path	Z 50 YDS	-1.5	0.0	0.2	-1.1	-4.2	-9.5
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-1.4	-4.6	-10.0
Line of Sight	O 150 YDS	-1.5	0.4	0.9	0.0	-2.8	-7.6

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2700	2495	2299	2112	1934	1766
Energy, Ft-Lb Per Grain			16.18	13.82	11.73	9.90	8.30	6.92
Time of Flight, Seconds			0.0000	0.0578	0.1204	0.1885	0.2627	0.3439
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.4	-4.9	-10.8
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-1.6	-5.1	-11.0
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.0	-8.4
Velocity, FPS			2600	2400	2208	2025	1851	1688
Energy, Ft-Lb Per Grain			15.01	12.79	10.82	9.10	7.61	6.33
Time of Flight, Seconds			0.0000	0.0601	0.1252	0.1962	0.2737	0.3585
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.8	-5.7	-12.2
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-5 7	-12.2
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.3	-9.2
Velocity, FPS			2500	2304	2116	1938	1770	1612
Energy, Ft-Lb Per Grain			13.88	11.79	9.94	8.34	6.96	5.77
Time of Flight, Seconds			0.0000	0.0625	0.1304	0.2045	0.2855	0.3743
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.2	-6.6	-13.8
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.0	-6.4	-13 5
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.7	-10.1
Velocity, FPS			2400	2208	2025	1852	1689	1538
Energy, Ft-Lb Per Grain			12.79	10.82	9.10	7.61	6.33	5.25
Time of Flight, Seconds			0.0000	0.0652	0.1361	0.2136	0.2984	0.3915
Bullet Path	Z	50 YDS	-1.5	0.0	-0 3	-2.7	-7.7	-15.7
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.3	-7.1	-14.9
Line of Sight	O	150 YDS	-1.5	0.9	1.5	0.0	-4.1	-11.2
Velocity, FPS			2300	2113	1935	1766	1609	1465
Energy, Ft-Lb Per Grain			11.74	9.91	8.31	6.92	5.75	4.76
Time of Flight, Seconds			0.0000	0.0680	0.1422	0.2234	0.3124	0.4101
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.2	-8.8	-17.7
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.6	-7.9	-16.6
Line of Sight	O	150 YDS	-1.5	1.1	1.7	0.0	-4.5	-12.4
Velocity, FPS			2200	2017	1844	1682	1531	1394
Energy, Ft-Lb Per Grain			10.75	9.03	7.55	6.28	5.20	4.31
Time of Flight, Seconds			0.0000	0.0712	0.1490	0.2342	0.3277	0.4304
Bullet Path	Z	50 YDS	-1.5	0.0	-0.6	-3.8	-10.1	-20.1
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.9	-8.8	-18.5
Line of Sight	O	150 YDS	-1 5	1.3	1.9	0.0	-5.0	-13.7
Velocity, FPS			2100	1922	1755	1599	1455	1327
Energy, Ft-Lb Per Grain			9.79	8.20	6.84	5.68	4.70	3.91
Time of Flight, Seconds			0.0000	0.0747	0.1563	0.2459	0.3443	0.4523
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-4.5	-11.6	-22.9
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.3	-9.9	-20.7
Line of Sight	O	150 YDS	-1.5	1.5	2.2	0.0	-5.6	-15.3

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2000	1828	1666	1517	1382	I263
Energy, Ft-Lb Per Grain			8.88	7.42	6.16	5.11	4.24	3.54
Time of Flight, Seconds			0.0000	0.0785	0 1644	0.2588	0.3624	0.4761
Bullet Path	Z	50 YDS	-1.5	0.0	-1.1	-5.4	-13.4	-26.0
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.7	-11.2	-23.2
Line of Sight	O	150 YDS	-1.5	1.8	2.5	0.0	-6.2	-17.1
Velocity, FPS			1900	1734	1579	1438	1311	1203
Energy, Ft-Lb Per Grain			8.01	6.68	5.54	4.59	3.82	3.21
Time of Flight, Seconds			0.0000	0.0827	0.1733	0.2729	0.3823	0.5018
Bullet Path	Z	50 YDS	-1.5	0.0	-1.4	-6.3	-15.4	-29.6
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.2	-12.6	-26.1
Line of Sight	O	150 YDS	-1.5	2.1	2.8	0.0	-7.0	-19.1
Velocity, FPS			1800	1641	1493	1360	1245	1149
Energy, Ft-Lb Per Grain			7.19	5.98	4.95	4.11	3.44	2.93
Time of Flight, Seconds			0.0000	0.0873	0.1832	0.2885	0.4039	0.5294
Bullet Path	Z	50 YDS	-1.5	0.0	-1.7	-7.4	-17.7	-33.7
(Inches) +/-	E R	100 YDS	-1.5	0.9	0.0	-4.8	-14.3	-29.3
Line of Sight	O	150 YDS	-1.5	2.5	3.2	0.0	-7.9	-21.4
Velocity, FPS			1700	1548	1409	1287	1183	1101
Energy, Ft-Lb Per Grain			6.42	5.32	4.41	3.68	3.11	2.69
Time of Flight, Seconds			0.0000	0.0925	0.1941	0.3056	0.4273	0.5589
Bullet Path	Z	50 YDS	-1.5	0.0	-2.1	-8.7	-20.4	-38.4
Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-5.5	-16.2	-33.1
Line of Sight	O	150 YDS	-1.5	2.9	3.6	0.0	-8.9	-24.0
Velocity, FPS			1600	1456	1328	1217	1127	1058
Energy, Ft-Lb Per Grain			5.68	4.71	3.92	3.29	2.82	2.49
Time of Flight, Seconds			0.0000	0.0983	0.2062	0.3244	0.4526	0.5901
Bullet Path	Z	50 YDS	-1.5	0.0	-2.6	-10.2	-23.6	-43.8
(Inches) +/-	E R	100 YDS	-1.5	1.3	0.0	-6.2	-18.4	-37.3
Line of Sight	O	150 YDS	-1.5	3.4	4.2	0.0	-10.0	-26.9
Velocity, FPS			1500	1366	1250	1153	1078	1019
Energy, Ft-Lb Per Grain			5.00	4.14	3.47	2.95	2.58	2.31
Time of Flight, Seconds			0.0000	0.1048	0.2197	0.3449	0.4796	0.6229
Bullet Path	Z	50 YDS	-1.5	0.0	-3.2	-11.9	-27.2	-49.9
(Inches) +/-	E R	100 YDS	-1.5	1.6	0.0	-7.2	-20.8	-42.0
Line of Sight	O	150 YDS	-1.5	4.0	4.8	0.0	-11.3	-30.1
Velocity, FPS			1400	1278	1176	1096	1033	984
Energy, Ft-Lb Per Grain			4.35	3.63	3.07	2.67	2.37	2.15
Time of Flight, Seconds			0.0000	0.1122	0.2347	0.3669	0.5081	0.6570
Bullet Path	Z	50 YDS	-1.5	0.0	-3.8	-13.9	-31.2	-56.7
(Inches) +/-	E R	100 YDS	-1.5	1.9	0.0	-8.2	-23.6	-47.2
Line of Sight	O	150 YDS	-1.5	4.6	5.5	0.0	-12.7	-33.5

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1300	1194	1109	1044	992	950
Energy, Ft-Lb Per Grain			3.75	3.17	2.73	2.42	2.18	2.00
Time of Flight, Seconds			0.0000	0.1205	0.2510	0.3906	0.5381	0.6927
Bullet Path	Z	50 YDS	-1.5	0.0	-4.6	-16.2	-35.9	-64.3
(Inches) +/-	E R	100 YDS	-1.5	2.3	0.0	-9.3	-26.7	-52.8
Line of Sight	O	150 YDS	-1.5	5.4	6.2	0.0	-14.2	-37.2
Velocity, FPS			1200	1114	1048	995	952	915
Energy, Ft-Lb Per Grain			3.20	2.76	2.44	2.20	2.01	1.86
Time of Flight, Seconds			0.0000	0.1299	0.2689	0.4160	0.5702	0.7309
Bullet Path	Z	50 YDS	-1.5	0.0	-5.5	-18.9	-41.1	-72.8
(Inches) +/-	E R	100 YDS	-1.5	2.7	0.0	-10.7	-30.1	-59.1
Line of Sight	O	150 YDS	-1.5	6.3	7.1	0.0	-15.9	-41.3
Velocity, FPS			1100	1037	986	945	909	877
Energy, Ft-Lb Per Grain			2.69	2.39	2.16	1.98	1.83	1.71
Time of Flight, Seconds			0.0000	0.1406	0.2891	0.4446	0.6065	0.7747
Bullet Path	Z	50 YDS	-1.5	0.0	-6.6	-22.1	-47.3	-83.1
(Inches) +/-	E R	100 YDS	-1.5	3.3	0.0	-12.2	-34.2	-66.7
Line of Sight	O	150 YDS	-1.5	7.4	8.1	0.0	-17.9	-46.3
Velocity, FPS			1000	956	919	885	855	828
Energy, Ft-Lb Per Grain			2.22	2.03	1.87	1.74	1.62	1.52
Time of Flight, Seconds			0.0000	0.1535	0.3136	0.4800	0.6525	0.8308
Bullet Path	Z	50 YDS	-1.5	0.0	-8.0	-26.3	-55.7	-97.0
(Inches) +/-	E R	100 YDS	-1.5	4.0	0.0	-14.3	-39.7	-77.0
Line of Sight	O	150 YDS	-1.5	8.8	9.5	0.0	-20.6	-53.1

Exterior Ballistic Table for Ballistic Coefficient 0.23

Velocity FPS			2900	2695	2499	2311	2131	1960
Energy, Ft-Lb Per Grain			18.67	16.12	13.86	11.86	10.08	8.53
Time of Flight, Seconds			0.0000	0.0537	0.1115	0.1739	0.2415	0.3149
Bullet Path	Z	50 YDS	-1.5	0.0	0.3	-0.8	-3.5	-8.2
(Inches) +/-	E R	100 YDS	-1.5	-0.2	0.0	-1.2	-4.1	-8.9
Line of Sight	O	150 YDS	-1.5	0.3	0.8	0.0	-2.5	-6.8
Velocity, FPS			2800	2599	2408	2224	2048	1880
Energy, Ft-Lb Per Grain			17.41	15.00	12.87	10.98	9.31	7.85
Time of Flight, Seconds			0.0000	0.0556	0.1156	0.1804	0.2507	0.3271
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.1	-4.1	-9.3
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.4	-4.6	-9.8
Line of Sight	O	150 YDS	-1.5	0.4	0.9	0.0	-2.7	-7.5
Velocity, FPS			2700	2504	2316	2136	1964	1801
Energy, Ft-Lb Per Grain			16.18	13.92	11.91	10.13	8.56	7.20
Time of Flight, Seconds			0.0000	0.0577	0.1200	0.1874	0.2607	0.3404
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.4	-4.8	-10.5
(Inches) +/-	E R	100 YDS	-1.5	4.1	0.0	-1.6	-5.0	-10.8
Line of Sight	O	150 YDS	-1.5	0.5	1.0	0.0	-3.0	-8.2

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2600	2408	2224	2048	1881	1723
Energy, Ft-Lb Per Grain			15.01	12.87	10.98	9.31	7.85	6.59
Time of Flight, Seconds			0.0000	0.0599	0.1248	0.1950	0.2715	0.3548
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.8	-5.6	-11.9
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.8	-5.6	-11.9
Line of Sight	O	150 YDS	-1.5	0.6	1.2	0.0	-3.3	-9.0
Velocity, FPS			2500	2312	2132	1961	1798	1645
Energy, Ft-Lb Per Grain			13.88	11.87	10.09	8.54	7.18	6.01
Time of Flight, Seconds			0.0000	0.0624	0.1299	0.2033	0.2832	0.3704
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.2	-6.5	13.5
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.0	-6.2	-13.2
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.6	-9.9
Velocity, FPS			2400	2216	2041	1874	1716	1569
Energy, Ft-Lb Per Grain			12.79	10.90	9.25	7.80	6.54	5.47
Time of Flight, Seconds			0.0000	0.0650	0.1356	0.2123	0.2959	0.3874
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-2.6	-7.5	-15.3
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.2	-6.9	-14.6
Line of Sight	O	150 YDS	-1.5	0.9	1.5	0.0	-4.0	-10.9
Velocity, FPS			2300	2121	1950	1788	1636	1495
Energy, Ft-Lb Per Grain			11.74	9.99	8.44	7.10	5.94	4.96
Time of Flight, Seconds			0.0000	0.0679	0.1417	0.2220	0.3098	0.4057
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-3.2	-8.6	-17.3
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.5	-7.7	-16.2
Line of Sight	O	150 YDS	-1.5	1.1	1.7	0.0	-4.4	-12.1
Velocity, FPS			2200	2025	1859	1702	1557	1423
Energy, Ft-Lb Per Grain			10.75	9.10	7.67	6.43	5.38	4.50
Time of Flight, Seconds			0.0000	0.0711	0.1484	0.2327	0.3249	0.4257
Bullet Path	Z	50 YDS	-1.5	0.0	-0.6	-3.8	-9.9	-19.7
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.8	-8.7	-18.1
Line of Sight	O	150 YDS	-1.5	1.3	1.9	0.0	-4.9	-13.4
Velocity, FPS			2100	1930	1769	1618	1479	1353
Energy, Ft-Lb Per Grain			9.79	8.27	6.95	5.81	4.86	4.06
Time of Flight, Seconds			0.0000	0.0745	0.1557	0.2444	0.3413	0.4474
Bullet Path	Z	50 YDS	-1.5	0.0	-0.8	-4.5	-11.4	-22.3
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.2	-9.7	-20.2
Line of Sight	O	150 YDS	-1.5	1.5	2.1	0.0	-5.5	-14.9
Velocity, FPS			2000	1835	1680	1536	1404	1287
Energy, Ft-Lb Per Grain			8.88	7.48	6.27	5.24	4.38	3.68
Time of Flight, Seconds			0.0000	0.0783	0.1637	0.2572	0.3593	0.4710
Bullet Path	Z	50 YDS	-1.5	0.0	-1.1	-5.3	-13.1	-25.4
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.6	-11.0	-22.7
Line of Sight	O	150 YDS	-1.5	1.8	2.4	0.0	-6.1	-16.6

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1900	1741	1592	1455	1332	1225
Energy, Ft-Lb Per Grain		8.01	6.73	5.63	4.70	3.94	3.33
Time of Flight, Seconds		0.0000	0.0825	0.1726	0.2712	0.3790	0.4965
Bullet Path	Z 50 YDS	-1.5	0.0	-1.4	-6.2	-15.1	-28.9
(Inches) +/-	E R 100 YDS	-1.5	0.7	0.0	-4.1	-12.4	-25.5
Line of Sight	O 150 YDS	-1.5	2.1	2.7	0.0	-6.9	-18.6
Velocity, FPS		1800	1647	1506	1377	1263	1168
Energy, Ft-Lb Per Grain		7.19	6.02	5.04	4.21	3.54	3.03
Time of Flight, Seconds		0.0000	0.0871	0.1824	0.2866	0.4005	0.5241
Bullet Path	Z 50 YDS	-1.5	0.0	-1.7	-7.3	-17.4	-33.0
Inches) +/-	E R 100 YDS	-1.5	0.9	0.0	-4.7	-14.0	-28.7
Line of Sight	O 150 YDS	-1.5	2.4	3.1	0.0	-7.7	-20.9
Velocity, FPS		1700	1554	1421	1302	1200	1117
Energy, Ft-Lb Per Grain		6.42	5.36	4.48	3.76	3.20	2.77
Time of Flight, Seconds		0.0000	0.0923	0.1933	0.3037	0.4238	0.5536
Bullet Path	Z 50 YDS	-1.5	0.0	-2.1	-8.5	-20.1	-37.7
(Inches) +/-	E R 100 YDS	-1.5	1.1	0.0	-5.4	-15.9	-32.4
Line of Sight	O 150 YDS	-1.5	2.8	3.6	0.0	-8.7	-23.5
Velocity FPS		1600	1462	1338	1230	1141	1072
Energy, Ft-Lb Per Grain		5.68	4.75	3.97	3.36	2.89	2.55
Time of Flight, Seconds		0.0000	0.0981	0.2054	0.3224	0.4491	0.5849
Bullet Path	Z 50 YDS	-1.5	0.0	-2.6	-10.0	-23.2	-43.0
(Inches) +/-	E R 100 YDS	-1.5	1.3	0.0	-6.1	-18.0	-36.6
Line of Sight	O 150 YDS	-1.5	3.3	4.1	0.0	-9.8	-26.3
Velocity, FPS		1500	1372	1259	1164	1090	1031
Energy, Ft-Lb Per Grain		5.00	4.18	3.52	3.01	2.64	2.36
Time of Flight, Seconds		0.0000	0.1046	0.2189	0.3429	0.4762	0.6179
Bullet Path	Z 50 YDS	-1.5	0.0	-3.1	-11.7	-26.8	-49.1
(Inches) +/-	E R 100 YDS	-1.5	1.6	0.0	-7.0	-20.5	-41.3
Line of Sight	O 150 YDS	-1.5	3.9	4.7	0.0	-11.1	-29.5
Velocity, FPS		1400	1283	1184	1105	1043	994
Energy, Ft-Lb Per Grain		4.35	3.65	3.11	2.71	2.42	2.19
Time of Flight, Seconds		0.0000	0.1120	0.2338	0.3650	0.5049	0.6524
Bullet Path	Z 50 YDS	-1.5	0.0	-3.8	-13.8	-30.8	-55.9
(Inches) +/-	E R 100 YDS	-1.5	1.9	0.0	-8.1	-23.3	-46.4
Line of Sight	O 150 YDS	-1.5	4.6	5.4	0.0	-12.5	-33.0
Velocity, FPS		1300	1198	1116	1052	1001	959
Energy, Ft-Lb Per Grain		3.75	3.19	2.76	2.46	2.22	2.04
Time of Flight, Seconds		0.0000	0.1203	0.2502	0.3888	0.5351	0.6884
Bullet Path	Z 50 YDS	-1.5	0.0	-4.6	-16.1	-35.4	-63.5
(Inches) +/-	E R 100 YDS	-1.5	2.3	0.0	-9.2	-26.3	-52.1
Line of Sight	O 150 YDS	-1.5	5.4	6.2	0.0	-14.0	-36.7

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1200	1117	1053	1001	959	923
Energy, Ft-Lb Per Grain		3.20	2.77	2.46	2.22	2.04	1.89
Time of Flight, Seconds		0.0000	0.1297	0.2682	0.4144	0.5675	0.7270
Bullet Path	Z 50 YDS	-1.5	0.0	-5.5	-18.7	-40.7	-72.1
(Inches) +/-	E R 100 YDS	-1.5	2.7	0.0	-10.6	-29.8	-58.4
Line of Sight	O 150 YDS	-1.5	6.2	7.0	0.0	-15.7	-40.8
Velocity, FPS		1100	1039	990	950	915	883
Energy, Ft-Lb Per Grain		2.69	2.40	2.18	2.00	1.86	1.73
Time of Flight, Seconds		0.0000	0.1404	0.2884	0.4432	0.6042	0.7712
Bullet Path	Z 50 YDS	-1.5	0.0	-6.5	-21.9	-47.0	-82.4
(Inches) +/-	E R 100 YDS	-1.5	3.3	0.0	-12.1	-33.9	-66.0
Line of Sight	O 150 YDS	-1.5	7.3	8.1	0.0	-17.7	-45.8
Velocity, FPS		1000	958	922	890	861	834
Energy, Ft-Lb Per Grain		2.22	2.04	1.89	1.76	1.65	1.54
Time of Flight, Seconds		0.0000	0.1533	0.3131	0.4788	0.6504	0.8275
Bullet Path	Z 50 YDS	-1.5	0.0	-8.0	-26.2	-55.4	-96.3
(Inches) +/-	E R 100 YDS	-1.5	4.0	0.0	-14.2	-39.4	-76.3
Line of Sight	O 150 YDS	-1 5	8.7	9.5	0.0	-20.5	-52.7

Exterior Ballistic Table for Ballistic Coefficient 0.24

Velocity, FPS		2900	2703	2515	2334	2161	1995
Energy, Ft-Lb Per Grain		18.67	16.22	14.04	12.09	10.37	8.84
Time of Flight, Seconds		0.0000	0.0536	0.1111	0.1730	0.2398	0.3121
Bullet Path	Z 50 YDS	-1.5	0.0	0.3	-0.8	-3.4	-8.0
(Inches) +/-	E R 100 YDS	-1.5	-0.2	0.0	-1.2	-4 0	-8.7
Line of Sight	O 150 YDS	-1.5	0.3	0.8	0.0	-2.4	-6.7
Velocity, FPS		2800	2608	2423	2246	2077	1915
Energy, Ft-Lb Per Grain		17.41	15.10	13.03	11.20	9.58	8.14
Time of Flight, Seconds		0.0000	0.0555	0.1152	0.1795	0.2489	0.3242
Bullet Path	Z 50 YDS	-1.5	0.0	0.2	-1.0	-4.0	-9.0
(Inches) +/-	E R 100 YDS	-1.5	-0.1	0.0	-1.4	-4.5	-9.6
Line of Sight	O 150 YDS	-1.5	0.3	0.9	0.0	-2.6	-7.3
Velocity, FPS		2700	2512	2331	2158	1992	1834
Energy, Ft-Lb Per Grain		16.18	14.01	12.06	10.34	8.81	7.47
Time of Flight, Seconds		0.0000	0.0576	0.1196	0.1865	0.2588	0.3373
Bullet Path	Z 50 YDS	-1.5	0.0	0.1	-1.4	-4.7	-10.3
(Inches) +/-	E R 100 YDS	-1.5	-0.1	0.0	-1.5	-5.0	-10.6
Line of Sight	O 150 YDS	-1.5	0.5	1.0	0.0	-2.9	-8.0
Velocity, FPS		2600	2416	2239	2070	1908	1755
Energy, Ft-Lb Per Grain		15.01	12.96	11.13	9.51	8.08	6.84
Time of Flight, Seconds		0.0000	0.0599	0.1243	0.1940	0.2695	0.3515
Bullet Path	Z 50 YDS	-1.5	0.0	0.0	-1.7	-5.5	-11.6
(Inches) +/-	E R 100 YDS	-1 5	0.0	0.0	-1.7	-5.5	-11.7
Line of Sight	O 150 YDS	-1.5	0.6	1.2	0.0	-3.2	-8.8

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.24

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		2500	2320	2147	1982	1825	1676
Energy, Ft-Lb Per Grain		13.88	11.95	10.23	8.72	7.39	6.24
Time of Flight, Seconds		0.0000	0.0623	0.1295	0.2022	0.2811	0.3669
Bullet Path	Z 50 YDS	-1.5	0.0	-0.1	-2.1	-6.3	-13.2
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-1.9	-6.1	-12.9
Line of Sight	O 150 YDS	-1.5	0.7	1.3	0.0	-3.5	-9.6
Velocity, FPS		2400	2224	2055	1894	1742	1599
Energy, Ft-Lb Per Grain		12.79	10.98	9.38	7.96	6.74	5.68
Time of Flight, Seconds		0.0000	0.0649	0.1351	0.2111	0.2937	0.3836
Bullet Path	Z 50 YDS	-1.5	0.0	-0.3	-2.6	-7.3	-15.0
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-2.2	-6.8	-14.3
Line of Sight	O 150 YDS	-1.5	0.9	1.5	0.0	-3.9	-10.6
Velocity, FPS		2300	2128	1964	1807	1660	1523
Energy, Ft-Lb Per Grain		11.74	10.05	8.56	7.25	6.12	5.15
Time of Flight, Seconds		0.0000	0.0678	0.1412	0.2208	0.3074	0.4018
Bullet Path	Z 50 YDS	-1.5	0.0	-0.4	-3.1	-8.5	-17.0
(Inches) +/-	E R 100 YDS	-1.5	0.2	0.0	-2.5	-7.6	-15.9
Line of Sight	O 150 YDS	-1.5	1.0	1.6	0.0	-4.3	-11.8
Velocity, FPS		2200	2032	1873	1721	1580	1450
Energy, Ft-Lb Per Grain		10.75	9.17	7.79	6.58	5.54	4.67
Time of Flight, Seconds		0.0000	0.0709	0.1478	0.2314	0.3224	0.4215
Bullet Path	Z 50 YDS	-1.5	0.0	-0.6	-3.7	-9.7	-19.3
(Inches) +/-	E R 100 YDS	-1.5	0.3	0.0	-2.8	-8.5	-17.7
Line of Sight	O 150 YDS	-1.5	1.2	1.9	0.0	-4.8	-13.1
Velocity, FPS		2100	1937	1782	1637	1502	1378
Energy, Ft-Lb Per Grain		9.79	8.33	7.05	5.95	5.01	4.22
Time of Flight, Seconds		0.0000	0.0744	0.1551	0.2430	0.3387	0.4430
Bullet Path	Z 50 YDS	-1.5	0.0	-0.8	-4.4	-11.2	-21.9
(Inches) +/-	E R 100 YDS	-1.5	0.4	0.0	-3.2	-9.6	-19.8
Line of Sight	O 150 YDS	-1.5	1.5	2.1	0.0	-5.4	-14.6
Velocity, FPS		2000	1842	1693	1553	1425	1310
Energy, Ft-Lb Per Grain		8.88	7.53	6.36	5.35	4.51	3.81
Time of Flight, Seconds		0.0000	0.0782	0.1631	0.2557	0.3565	0.4664
Bullet Path	Z 50 YDS	-1.5	0.0	-1.1	-5.5	-12.9	-24.9
(Inches)+/-	E R 100 YDS	-1.5	0.5	0.0	-3.6	-10.8	-22.2
Line of Sight	O 150 YDS	-1.5	1.7	2.4	0.0	-6.0	-16.3
Velocity, FPS		1900	1747	1604	1472	1351	1246
Energy, Ft-Lb Per Grain		8.01	6.78	5.71	4.81	4.05	3.45
Time of Flight, Seconds		0.0000	0.0823	0.1720	0.2696	0.3760	0.4917
Bullet Path	Z 50 YDS	-1.5	0.0	-1.4	-6.1	-14.8	-28.4
(Inches) +/-	E R 100 YDS	-1.5	0.7	0.0	-4.1	-12.1	-25.0
Line of Sight	O 150 YDS	-1.5	2.0	2.7	0.0	-6.7	-18.2

Exterior Ballistic Table for Ballistic Coefficient 0.24

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1800	1653	1517	1392	1281	1186
Energy, Ft-Lb Per Grain			7.19	6.07	5.11	4.30	3.64	3.12
Time of Flight, Seconds			0.0000	0.0870	0.1817	0.2850	0.3974	0.5192
Bullet Path	Z	50 YDS	-1.5	0.0	-1.7	-7.2	-17.1	-32.4
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-4.6	-13.7	-28.2
Line of Sight	O	150 YDS	-1.5	2.4	3.1	0.0	-7.6	-20.5
Velocity, FPS			1700	1560	1431	1316	1215	1133
Energy, Ft-Lb Per Grain			6.42	5.40	4.55	3.84	3.28	2.85
Time of Flight, Seconds			0.0000	0.0921	0.1925	0.3019	0.4206	0.5486
Bullet Path	Z	50 YDS	-1.5	0.0	-2.1	-8.4	-19.8	-37.0
(Inches) +/-	E R	100 YDS	-1.5	1.0	0.0	-5.3	-15.6	-31.8
Line of Sight	O	150 YDS	-1.5	2.8	3.5	0.0	-8.6	-23.0
Velocity, FPS			1600	1468	1348	1243	1155	1085
Energy, Ft-Lb Per Grain			5.68	4.78	4.03	3.43	2.96	2.61
Time of Flight, Seconds			0.0000	0.0979	0.2046	0.3206	0.4459	0.5801
Bullet Path	Z	50 YDS	-1.5	0.0	-2.5	-9.9	-22.8	-42.3
(Inches) +/-	E R	100 YDS	-1.5	1.3	0.0	-6.1	-17.7	-35.9
Line of Sight	O	150 YDS	-1.5	3.3	4.0	0.0	-9.7	-25.8
Velocity, FPS			1500	1377	1268	1175	1101	1042
Energy, Ft-Lb Per Grain			5.00	4.21	3.57	3.07	2.69	2.41
Time of Flight, Seconds			0.0000	0.1044	0.2180	0.3411	0.4731	0.6133
Bullet Path	Z	50 YDS	-1.5	0.0	-3.1	-11.6	-26.4	-48.3
(Inches) +/-	E R	100 YDS	-1.5	1.5	0.0	-7.0	-20.2	-40.6
Line of Sight	O	150 YDS	-1.5	3.9	4.6	0.0	-10.9	-29.0
Velocity, FPS			1400	1288	1192	1114	1053	1003
Energy, Ft-Lb Per Grain			4.35	3.68	3.15	2.76	2.46	2.23
Time of Flight, Seconds			0.0000	0.1118	0.2330	0.3633	0.5019	0.6481
Bullet Path	Z	50 YDS	-1.5	0.0	-3.7	-13.6	-30.5	-55.2
(Inches) +/-	E R	100 YDS	-1.5	1.9	0.0	-8.0	-23.0	-45.8
Line of Sight	O	150 YDS	-1.5	4.5	5.3	0.0	-12.3	-32.5
Velocity, FPS			1300	1202	1122	1059	1008	967
Energy, Ft-Lb Per Grain			3.75	3.21	2.79	2.49	2.26	2.08
Time of Flight, Seconds			0.0000	0.1201	0.2494	0.3872	0.5324	0.6845
Bullet Path	Z	50 YDS	-1.5	0.0	-4.5	-15.9	-35.1	-62.8
(Inches) +/-	E R	100 YDS	-1.5	2.3	0.0	-9.2	-26.0	-51.5
Line of Sight	O	150 YDS	-1.5	5.3	6.1	0.0	-13.8	-36.2
Velocity, FPS			1200	1120	1058	1007	966	930
Energy, Ft-Lb Per Grain			3.20	2.78	2.49	2.25	2.07	1.92
Time of Flight, Seconds			0.0000	0.1295	0.2675	0.4129	0.5651	0.7234
Bullet Path	Z	50 YDS	-1.5	0.0	-5.4	-18.6	-40.3	-71.4
(Inches) +/-	E R	100 YDS	-1.5	2.7	0.0	-10.5	-29.5	-57.8
Line of Sight	O	150 YDS	-1.5	6.2	7.0	0.0	-15.5	-40.4

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.24

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1100	1041	994	955	920	890
Energy, Ft-Lb Per Grain			2.69	2.41	2.19	2.02	1.88	1.76
Time of Flight, Seconds			0.0000	0.1403	0.2878	0.4419	0.6021	0.7679
Bullet Path	Z	50 YDS	-1.5	0.0	-6.5	-21.8	-46.6	-81.7
(Inches) +/-	E R	100 YDS	-1.5	3.3	0.0	-12.0	-33.6	-65.5
Line of Sight	O	150 YDS	-1.5	7.3	8.0	0.0	-17.6	-45.4
Velocity, FPS			1000	960	925	893	865	839
Energy, Ft-Lb Per Grain			2.22	2.05	1.90	1.77	1.66	1.56
Time of Flight, Seconds			0.0000	0.1532	0.3126	0.4776	0.6484	0.8244
Bullet Path	Z	50 YDS	-1.5	0.0	-7.9	-26.0	-55.0	-95.6
(Inches) +/-	E R	100 YDS	-1.5	4.0	0.0	-14.1	-33.2	-75.8
Line of Sight	O	150 YDS	-1.5	8.7	9.4	0.0	-20.3	-52.2

Exterior Ballistic Table for Ballistic Coefficient 0.25

Velocity, FPS			2900	2711	2530	2356	2188	2028
Energy, Ft-Lb Per Grain			18.67	16.32	14.21	12.32	10.63	9.13
Time of Flight, Seconds			0.0000	0.0535	0.1108	0.1722	0.2383	0.3095
Bullet Path	Z	50 YDS	-1.5	0.0	0.3	-0.7	-3.3	-7.8
(Inches) +/-	E R	100 YDS	-1.5	-0.2	0.0	-1.2	-4.0	-8.6
Line of Sight	O	150 YDS	-1.5	0.2	0.8	0.0	-2.4	-6.6
Velocity, FPS			2800	2615	2438	2267	2103	1946
Energy, Ft-Lb Per Grain			17.41	15.18	13.20	11.41	9.82	8.41
Time of Flight, Seconds			0.0000	0.0554	0.1148	0.1787	0.2474	0.3215
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.0	-3.9	-8.8
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.4	-4.4	-9.4
Line of Sight	O	150 YDS	-1.5	0.3	0.9	0.0	-2.6	-7.2
Velocity, FPS			2700	2519	2345	2178	2018	1865
Energy, Ft-Lb Per Grain			16.18	14.09	12.21	10.53	9.04	7.72
Time of Flight, Seconds			0.0000	0.0575	0.1192	0.1856	0.2571	0.3344
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.3	-4.6	-10.0
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.5	-4.9	-10.4
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-2.8	-7.8
Velocity, FPS			2600	2423	2253	2090	1933	1785
Energy, Ft-Lb Per Grain			15.01	13.03	11.27	9.70	8.30	7.07
Time of Flight, Seconds			0.0000	0.0598	0.1240	0.1931	0.2677	0.3485
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.7	-5.4	-11.4
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.7	5.4	-11.4
Line of Sight	O	150 YDS	-1.5	0.6	1.1	0.0	-3.1	-8.6
Velocity, FPS			2500	2327	2161	2001	1849	1705
Energy, Ft-Lb Per Grain			13.88	12.02	10.37	8.89	7.59	6.45
Time of Flight, Seconds			0.0000	0.0622	0.1291	0.2012	0.2792	0.3637
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.1	-6.2	-12.9
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-1.9	-6.0	-12.7
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.5	-9.5

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		2400	2231	2068	1913	1766	1627
Energy, Ft-Lb Per Grain		12.79	11.05	9.49	8.12	6.92	5.88
Time of Flight, Seconds		0.0000	0.0648	0.1347	0.2101	0.2917	0.3802
Bullet Path	Z 50 YDS	-1.5	0.0	-0.2	-2.5	-7.2	-14.7
(Inches) +/-	E R 100 YDS	-1.5	0.1	0.0	-2.2	-6.7	-14.0
Line of Sight	O 150 YDS	-1.5	0.8	1.4	0.0	-3.8	-10.4
Velocity, FPS		2300	2135	1976	1826	1683	1550
Energy, Ft-Lb Per Grain		11.74	10.12	8.67	7.40	6.29	5.33
Time of Flight, Seconds		0.0000	0.0677	0.1407	0.2197	0.3053	0.3982
Bullet Path	Z 50 YDS	-1.5	0.0	-0.4	-3.1	-8.3	-16.6
(Inches) +/-	E R 100 YDS	-1.5	0.2	0.0	-2.4	-7.5	-15.6
Line of Sight	O 150 YDS	-1.5	1.0	1.6	0.0	-4.2	-11.5
Velocity, FPS		2200	2039	1885	1739	1602	1475
Energy, Ft-Lb Per Grain		10.75	9.23	7.89	6.71	5.70	4.83
Time of Flight, Seconds		0.0000	0.0708	0.1473	0.2302	0.3201	0.4177
Bullet Path	Z 50 YDS	-1.5	0.0	-0.6	-3.6	-9.6	-18.9
(Inches) +/-	E R 100 YDS	-1.5	0.3	0 0	-2.7	-8.4	-17.4
Line of Sight	O 150 YDS	-1.5	1.2	1.8	0.0	-4.7	-12.8
Velocity, FPS		2100	1943	1794	1654	1522	1402
Energy, Ft-Lb Per Grain		9.79	8.38	7.15	6.07	5.14	4.36
Time of Flight, Seconds		0.0000	0.0743	0.1546	0.2417	0.3363	0.4390
Bullet Path	Z 50 YDS	-1.5	0.0	-0.8	-4.3	-11.0	-21.5
(Inches) +/-	E R 100 YDS	-1.5	0.4	0.0	-3.1	-9.4	-19.5
Line of Sight	O 150 YDS	-1.5	1.4	2.1	0.0	-5.3	-14.3
Velocity, FPS		2000	1848	1704	1569	1445	1332
Energy, Ft-Lb Per Grain		8.88	7.58	6.45	5.47	4.64	3.94
Time of Flight, Seconds		0.0000	0.0780	0.1626	0.2543	0.3540	0.4621
Bullet Path	Z 50 YDS	-1.5	0.0	-1.0	-5.1	-12.7	-24.4
(Inches) +/-	E R 100 YDS	-1.5	0.5	0.0	-3.5	-10.6	-21.8
Line of Sight	O 150 YDS	-1.5	1.7	2.3	0.0	-5.9	-15.9
Velocity, FPS		1900	1753	1615	1487	1370	1266
Energy, Ft-Lb Per Grain		8.01	6.82	5.79	4.91	4.17	3.56
Time of Flight ,Seconds		0.0000	0.0822	0.1714	0.2682	0.3733	0.4873
Bullet Path	Z 50 YDS	-1.5	0.0	-1.3	-6.0	-14.6	-27.9
(Inches) +/-	E R 100 YDS	-1.5	0.7	0.0	-4.0	-11.9	-24.5
Line of Sight	O 150 YDS	-1.5	2.0	2.7	0.0	-6.6	-17.9
Velocity, FPS		1800	1659	1528	1406	1298	1204
Energy, Ft-Lb Per Grain		7.19	6.11	5.18	4.39	3.74	3.27
Time of Flight, Seconds		0.0000	0.0868	0.1811	0.2834	0.3945	0.514
Bullet Path	Z 50 YDS	-1.5	0.0	-1.7	-7.1	-16.9	-31.8
(Inches) +/-	E R 100 YDS	-1.5	0.8	0.0	-4.6	-13.5	-27.7
Line of Sight	O 150 YDS	-1.5	2.4	3.0	0.0	-7.4	-20.0

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1700	1566	1441	1329	1230	1148
Energy, Ft-Lb Per Grain		6.42	5.44	4.61	3.92	3.35	2.93
Time of Flight, Seconds		0.0000	0.0920	0.1919	0.3003	0.4177	0.5441
Bullet Path	Z 50 YDS	-1.5	0.0	-2.1	-8.3	-19.5	-36.4
(Inches) + /-	E R 100 YDS	-1.5	1.0	0.0	-5.2	-15.4	-31.2
Line of Sight	O 150 YDS	-1.5	2.8	3.5	0.0	-8.4	-22.6
Velocity, FPS		1600	1473	1357	1255	1168	1097
Energy, Ft-Lb Per Grain		5.68	4.82	4.09	3.50	3.03	2.67
Time of Flight, Seconds		0.0000	0.0977	0.2039	0.3189	0.4430	0.5756
Bullet Path	Z 50 YDS	-1.5	0.0	-2.5	-9.8	-22.5	-41.6
(Inches) +/-	E R 100 YDS	-1.5	1.3	0.0	-6.0	-17.5	-35.4
Line of Sight	O 150 YDS	-1.5	3.3	4.0	0.0	-9.5	-25.4
Velocity, FPS		1500	1381	1276	1185	1112	1053
Energy, Ft-Lb Per Grain		5.00	4.23	3.61	3.12	2.75	2.46
Time of Flight, Seconds		0.0000	0.1042	0.2173	0.3394	0.4702	0.6090
Bullet Path	Z 50 YDS	-1.5	0.0	-3.1	-11.5	-26.0	-47.7
(Inches) + /-	E R 100 YDS	-1.5	1.5	0.0	-6.9	-19.9	-40.0
Line of Sight	O 150 YDS	-1.5	3.8	4.6	0.0	-10.8	-28.6
Velocity, FPS		1400	1292	1199	1122	1061	1012
Energy, Ft-Lb Per Grain		4.35	3.71	3.19	2.79	2.50	2.27
Time of Flight, Seconds		0.0000	0.1116	0.2322	0.3616	0.4992	0.6440
Bullet Path	Z 150 YDS	-1.5	0.0	-3.7	-13.5	-30.1	-54.5
(Inches) +/-	E R 100 YDS	-1.5	1.9	0.0	-7.9	-22.7	-45.2
Line of Sight	O 150 YDS	-1.5	4.5	5.3	0.0	-12.2	-32.0
Velocity, FPS		1300	1206	1128	1066	1016	975
Energy, Ft-Lb Per Grain		3.75	3.23	2.82	2.52	2.29	2.11
Time of Flight, Seconds		0.0000	0.1199	0.2487	0.3856	0.5299	0.6808
Bullet Path	Z 150 YDS	-1.5	0.0	-4.5	-15.8	-34.7	-62.1
(Inches) +/-	E R 100 YDS	-1.5	2.2	0.0	-9.1	-25.8	-50.9
Line of Sight	O 150 YDS	-1.5	5.3	6.0	0.0	-13.7	-35.8
Velocity, FPS		1200	1123	1062	1013	972	937
Energy, Ft-Lb Per Grain		3.20	2.80	2.50	2.28	2.10	1.95
Time of Flight, Seconds		0.0000	0.1293	0.2668	0.4115	0.5628	0.7201
Bullet Path	Z 150 YDS	-1.5	0.0	-5.4	-18.5	-40.0	-70.7
(Inches) +/-	E R 100 YDS	-1.5	2.7	0.0	-10.4	-29.2	-57.3
Line of Sight	O 150 YDS	-1.5	6.2	6.9	0.0	-15.4	-40.0
Velocity, FPS		1100	1043	998	959	925	895
Energy, Ft-Lb Per Grain		2.69	2.42	2.21	2.04	1.90	1.78
Time of Flight, Seconds		0.0000	0.1401	0.2872	0.4407	0.6000	0.7650
Bullet Path	Z 150 YDS	-1.5	0.0	-6.5	-21.7	-46.3	-81.2
(Inches) +/-	E R 100 YDS	-1.5	3.2	0.0	-12.0	-33.4	-65.0
Line of Sight	O 150 YDS	-1.5	7.2	8.0	0.0	-17.4	-45.0

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1000	961	927	897	870	844
Energy, Ft-Lb Per Grain			2.22	2.05	1.91	1.79	1.68	1.58
Time of Flight, Seconds			0.0000	0.1531	0.3121	0.4766	0.6465	0.8216
Bullet Path	Z	150 YDS	-1.5	0.0	-7.9	-25.9	-54.7	-95.0
(Inches) +/-	E R	100 YDS	-1.5	4.0	0.0	-14.1	-38.9	-75.3
Line of Sight	O	150 YDS	-1.5	8.6	9.4	0.0	-20.2	-51.8

Exterior Ballistic Table for Ballistic Coefficient 0.26

Velocity, FPS			2300	2141	1988	1843	1704	1575
Energy, Ft-Lb Per Grain			11.74	10.18	8.77	7.54	6.45	5.51
Time of Flight, Seconds			0.0000	0.0676	0.1403	0.2187	0.3033	0.3949
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-3.0	-8.2	-16.3
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.4	- 7.4	-15.3
Line of Sight	O	150 YDS	-1.5	1.0	1.6	0.0	-4.2	-11.3

Velocity, FPS			2200	2045	1897	1755	1622	1498
Energy, Ft-Lb Per Grain			10.75	9.28	7.99	6.84	5.84	4.98
Time of Flight, Seconds			0.0000	0.0707	0.1469	0.2291	0.3180	0.4142
Bullet Path	Z	50 YDS	-1.5	0.0	-0.6	-3.6	-9.4	-18.5
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.7	-8.2	-17.1
Line of Sight	O	150 YDS	-1.5	1.2	1.8	0.0	-4.6	-12.6

Velocity, FPS			2100	1949	1805	1669	1542	1424
Energy, Ft-Lb Per Grain			9.79	8.43	7.23	6.18	5.28	4.50
Time of Flight, Seconds			0.0000	0.0741	0.1541	0.2405	0.3341	0.4353
Bullet Path	Z	50 YDS	-1.5	0.0	-0.8	-4.3	-10.8	-21.1
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.1	-9.3	-19.1
Line of Sight	O	150 YDS	-1.5	1.4	2.0	0.0	-5.2	-14.0

Velocity, FPS			2000	1854	1715	1584	1463	1353
Energy, Ft-Lb Per Grain			8.88	7.63	6.53	5.57	4.75	4.06
Time of Flight, Seconds			0.0000	0.0779	0.1621	0.2531	0.3516	0.4583
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-5.0	-12.5	-24.0
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.5	-10.4	-21.4
Line of Sight	O	150 YDS	-1.5	1.7	2.3	0.0	-5.8	-15.6

Velocity, FPS			1900	1759	1625	1501	1387	1284
Energy, Ft-Lb Per Grain			8.01	6.87	5.86	5.00	4.27	3.66
Time of Flight, Seconds			0.0000	0.0821	0.1708	0.2668	0.3708	0.4833
Bullet Path	Z	50 YDS	-1.5	0.0	-1.3	-5.9	-14.4	-27.4
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.0	-11.8	-24.1
Line of Sight	O	150 YDS	-1.5	2.0	2.6	0.0	-6.5	-17.5

Velocity, FPS			1800	1664	1537	1420	1314	1221
Energy, Ft-Lb Per Grain			7.19	6.15	5.24	4.48	3.83	3.31
Time of Flight, Seconds			0.0000	0.0867	0.1805	0.2820	0.3919	0.5105
Bullet Path	Z	50 YDS	-1.5	0.0	-1.6	-7.0	-16.6	-31.3
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-4.5	-13.3	-27.2
Line of Sight	O	150 YDS	-1.5	2.3	3.0	0.0	-7.3	-19.7

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.26

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1700	1571	1450	1341	1244	1162
Energy, Ft-Lb Per Grain			6.42	5.48	4.67	3.99	3.44	3.00
Time of Flight, Seconds			0.0000	0.0918	0.1912	0.2988	0.4150	0.5399
Bullet Path	Z	50 YDS	-1.5	0.0	-2.0	-8.2	-19.2	-35.8
(Inches) +/-	E R	100 YDS	-1.5	1.0	0.0	-5.2	-15.1	-30.7
Line of Sight	O	150 YDS	-1.5	2.7	3.4	0.0	-8.3	-22.2
Velocity, FPS			1600	1478	1365	1266	1180	1110
Energy, Ft-Lb Per Grain			5.68	4.85	4.14	3.56	3.09	2.74
Time of Flight, Seconds			0.0000	0.0976	0.2032	0.3174	0.4402	0.5715
Bullet Path	Z	50 YDS	-1.5	0.0	-2.5	-9.6	-22.2	-41.0
(Inches) +/-	E R	100 YDS	-1.5	1.2	0.0	-5.9	-17.2	-34.8
Line of Sight	O	150 YDS	-1.5	3.2	3.9	0.0	-9.4	-25.0

Exterior Ballistic Table for Ballistic Coefficient 0.27

Velocity, FPS			2900	2725	2556	2394	2237	2086
Energy, Ft-Lb Per Grain			18.67	16.49	14.50	12.72	11.11	9.66
Time of Flight, Seconds			0.0000	0.0534	0.1102	0.1708	0.2357	0.3051
Bullet Path	Z	50 YDS	-1.5	0.0	0.3	-0.7	-3.2	-7.5
(Inches) +/-	E R	100 YDS	-1.5	-0.2	0.0	-1.2	-3.9	-8.3
Line of Sight	O	150 YDS	-1.5	0.2	0.8	0.0	-2.3	-6.3
Velocity, FPS			2800	2629	2464	2304	2151	2004
Energy, Ft-Lb Per Grain			17.41	15.34	13.48	11.79	10.27	8.92
Time of Flight, Seconds			0.0000	0.0553	0.1142	0.1772	0.2446	0.3168
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.0	-3.8	-8.5
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.3	-4.3	-9.1
Line of Sight	O	150 YDS	-1.5	0.3	0.9	0.0	-2.5	-6.9
Velocity, FPS			2700	2532	2371	2215	2065	1921
Energy, Ft-Lb Per Grain			16.18	14.23	12.48	10.89	9.47	8.19
Time of Flight, Seconds			0.0000	0.0574	0.1186	0.1840	0.2542	0.3295
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.3	-4.4	-9.7
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.5	-4.7	-10.0
Line of Sight	O	150 YDS	-1.5	0.4	1.0	0.0	-2.8	-7.6
Velocity, FPS			2600	2436	2278	2125	1979	1839
Energy, Ft-Lb Per Grain			15.01	13.17	11.52	10.02	8.69	7.51
Time of Flight, Seconds			0.0000	0.0596	0.1233	0.1915	0.2646	0.3432
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.6	-5.2	-11.0
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.7	-5.2	-11.1
Line of Sight	O	150 YDS	-1.5	0.5	1.1	0.0	-3.0	-8.3
Velocity, FPS			2500	2340	2185	2036	1893	1758
Energy, Ft-Lb Per Grain			13.88	12.16	10.60	9.20	7.96	6.86
Time of Flight, Seconds			0.0000	0.0620	0.1284	0.1995	0.2759	0.3581
Bullet Path	Z	50 YDS	-1.5	0.0	-0.1	-2.0	-6.0	-12.5
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.9	-5.8	-12.2
Line of Sight	O	150 YDS	-1.5	0.7	1.2	0.0	-3.3	-9.1

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2400	2243	2092	1947	1808	1677
Energy, Ft-Lb Per Grain			12.79	11.17	9.72	8.42	7.26	6.24
Time of Flight, Seconds			0.0000	0.0646	0.1339	0.2082	0.2882	0.3743
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.4	-7.0	-14.1
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.1	-6.5	-13.6
Line of Sight	O	150 YDS	-1.5	0.8	1.4	0.0	-3.7	-10.1
Velocity, FPS			2300	2147	1999	1859	1724	1598
Energy, Ft-Lb Per Grain			11.74	10.23	8.87	7.67	6.60	5.67
Time of Flight, Seconds			0.0000	0.0675	0.1399	0.2177	0.3015	0.3919
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-3.0	-8 0	-16.1
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.4	-7 3	-15.1
Line of Sight	O	150 YDS	-1.5	1.0	1.6	0.0	-4.1	-11.1
Velocity, FPS			2200	2051	1907	1771	1642	1521
Energy, Ft-Lb Per Grain			10.75	9.34	8.07	6.96	5.99	5.14
Time of Flight, Seconds			0.0000	0.0706	0.1465	0.2281	0.3161	0.4111
Bullet Path	Z	50 YDS	-1.5	0.0	-0.6	-3.5	-9.3	-18.2
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.7	-8.1	-16.8
Line of Sight	O	150 YDS	-1.5	1.2	1.8	0.0	-4.6	-12.4
Velocity, FPS			2100	1955	1816	1684	1560	1445
Energy, Ft-Lb Per Grain			9.79	8.49	7.32	6.30	5.40	4.64
Time of Flight, Seconds			0.0000	0.0740	0.1537	0.2395	0.3320	0.4319
Bullet Path	Z	50 YDS	-1.5	0.0	-0.8	-4.2	-10.7	-20.8
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-3.0	-9.1	-18.8
Line of Sight	O	150 YDS	-1.5	1.4	2.0	0.0	-5.1	-13.8
Velocity, FPS			2000	1859	1725	1599	1481	1372
Energy, Ft-Lb Per Grain			8.88	7.67	6.61	5.68	4.87	4.18
Time of Flight, Seconds			0.0000	0.0778	0.1616	0.2519	0.3495	0.4547
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-5.0	-12.3	-23.6
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.4	-10.3	-21.1
Line of Sight	O	150 YDS	-1.5	1.7	2.3	0.0	-5.7	-15.4
Velocity, FPS			1900	1764	1635	1515	1403	1302
Energy, Ft-Lb Per Grain			8.01	6.91	5.93	5.10	4.37	3.76
Time of Flight, Seconds			0.0000	0.0819	0.1703	0.2656	0.3686	0.4796
Bullet Path	Z	50 YDS	-1.5	0.0	-1.3	-5.9	-14.2	-27.0
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.9	-11.6	-23.7
Line of Sight	O	150 YDS	-1.5	2.0	2.6	0.0	-6.4	-17.2
Velocity, FPS			1800	1669	1546	1432	1329	1237
Energy, Ft-Lb Per Grain			7.19	6.18	5.31	4.55	3.92	3.40
Time of Flight, Second			0.0000	0.0866	0.1799	0.2808	0.3895	0.5066
Bullet Path	Z	50 YDS	-1.5	0.0	-1.6	-6.9	-16.4	-30.8
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-4.5	-13.1	-26.8
Line of Sight	O	150 YDS	-1.5	2.3	3.0	0.0	-7.2	-19.3

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE		MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS		1700	1575	1459	1353	1258	1176
Energy, Ft-Lb Per Grain		6.42	5.51	4.73	4.06	3.51	3.07
Time of Flight, Seconds		0.0000	0.0917	0.1906	0.2975	0.4125	0.5360
Bullet Path	Z 50 YDS	-1.5	0.0	-2.0	-8.1	-19.0	-35.3
(Inches) +/-	E R 100 YDS	-1.5	1.0	0.0	-5.1	-14.9	-30.3
Line of Sight	O 150 YDS	-1.5	2.7	3.4	0.0	-8.1	-21.8
Velocity, FPS		1600	1482	1373	1276	1192	1122
Energy, Ft-Lb Per Grain		5.68	4.88	4.19	3.61	3.15	2.79
Time of Flight, Seconds		0.0000	0.0974	0.2026	0.3160	0.4377	0.5676
Bullet Path	Z 50 YDS	-1.5	0.0	-2.5	-9.5	-22.0	-40.5
(Inches) +/-	E R 100 YDS	-1.5	1.2	0.0	-5.8	-17.0	-34.3
Line of Sight	O 150 YDS	-1.5	3.2	3.9	0.0	-9.2	-24.6
Velocity, FPS		1500	1390	1291	1204	1132	1073
Energy, Ft-Lb Per Grain		5.00	4.29	3.70	3.22	2.84	2.56
Time of Flight, Seconds		0.0000	0.1039	0.2160	0.3364	0.4650	0.6013
Bullet Path	Z 50 YDS	-1.5	0.0	-3.0	-11.2	-25.4	-46.5
(Inches) +/-	E R 100 YDS	-1.5	1.5	0.0	-6.7	-19.4	-38.9
Line of Sight	O 150 YDS	-1.5	3.7	4.5	0.0	-10.5	-27.7
Velocity, FPS		1400	1300	1212	1138	1078	1029
Energy, Ft-Lb Per Grain		4.35	3.75	3.26	2.88	2.58	2.35
Time of Flight, Seconds		0.0000	0.1113	0.2309	0.3587	0.4943	0.6368
Bullet Path	Z 50 YDS	-1.5	0.0	-3.6	-13.2	-29.5	-53.2
(Inches) +/-	E R 100 YDS	-1.5	1.8	0.0	-7.7	-22.2	-44.1
Line of Sight	O 150 YDS	-1.5	4.4	5.2	0.0	-11.9	-31.2
Velocity, FPS		1300	1212	1138	1078	1030	989
Energy, Ft-Lb Per Grain		3.75	3.26	2.88	2.58	2.36	2.17
Time of Flight, Seconds		0.0000	0.1196	0.2474	0.3829	0.5254	0.6741
Bullet Path	Z 50 YDS	-1.5	0.0	-4.4	-15.5	-34.1	-60.9
(Inches) +/-	E R 100 YDS	-1.5	2.2	0.0	-8.9	-25.3	-49.9
Line of Sight	O 150 YDS	-1.5	5.2	5.9	0.0	-13.4	-35.0
Velocity, FPS		1200	1128	1070	1023	983	949
Energy, Ft-Lb Per Grain		3.20	2.82	2.54	2.32	2.15	2.00
Time of Flight, Seconds		0.0000	0.1290	0.2656	0.4091	0.5588	0.7141
Bullet Path	Z 50 YDS	-1.5	0.0	-5.3	-18.2	-39.4	-69.6
(Inches) +/-	E R 100 YDS	-1.5	2.7	0.0	-10.2	-28.8	-56.3
Line of Sight	O 150 YDS	-1.5	6.1	6.8	0.0	-15.1	-39.2
Velocity, FPS		1100	1047	1004	967	935	906
Energy, Ft-Lb Per Grain		2.69	2.43	2.24	2.08	1.94	1.82
Time of Flight, Seconds		0.0000	0.1399	0.2863	0.4386	0.5964	0.7595
Bullet Path	Z 50 YDS	-1.5	0.0	-6.4	-21.5	-45.8	-80.1
(Inches) +/-	E R 100 YDS	-1.5	3.2	0.0	-11.8	-32.9	-64.0
Line of Sight	O 150 YDS	-1.5	7.2	7.9	0.0	-17.2	-44.3

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1000	964	932	903	878	853
Energy, Ft-Lb Per Grain			2.22	2.06	1.93	1.81	1.71	1.62
Time of Flight, Seconds			0.0000	0.1529	0.3112	0.4748	0.6433	0.8168
Bullet Path	Z	50 YDS	-1.5	0.0	-7.9	-25.7	-54.2	-94.0
(Inches) +/-	E R	100 YDS	-1.5	3.9	0.0	-13.9	-38.5	-74.4
Line of Sight	O	150 YDS	-1.5	8.6	9.3	0.0	-19.9	-51.2

Exterior Ballistic Table for Ballistic Coefficient 0.30

Velocity, FPS			2400	2259	2122	1990	1863	1742
Energy, Ft-Lb Per Grain			12.79	11.33	10.00	8.79	7.71	6.74
Time of Flight, Seconds			0.0000	0.0644	0.1330	0.2060	0.2839	0.3671
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.3	-6.7	-13.5
(Inches) +/-	E R	100 YDS	-1 5	0.1	0.0	-2.0	-6.3	-13.0
Line of Sight	O	150 YDS	-1.5	0.8	1.4	0.0	-3.6	-9.6

Velocity, FPS			2300	2162	2028	1900	1777	1660
Energy, Ft-Lb Per Grain			11.74	10.38	913	8.01	7.01	6.12
Time of Flight, Seconds			0.0000	0.0673	0.1389	0.2153	0.2969	0.3843
Bullet Path	Z	50 YDS	-1.5	0.0	-0.4	-2.8	-7.7	-15.4
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.3	-7.0	-14.5
Line of Sight	O	150 YDS	-1.5	0.9	1.5	0.0	-3.9	-10.6

Velocity, FPS			2200	2065	1935	1811	1692	1580
Energy, Ft-Lb Per Grain			10.75	9.47	8.31	7.28	6.36	5.54
Time of Flight, Seconds			0.0000	0.0704	0.1454	0.2255	0.3112	0.4030
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.4	-8.9	-17.5
(Inches) +/-	E R	100 YDS	-1.5	0 3	0.0	-2.6	-7.8	-16.1
Line of Sight	O	150 YDS	-1.5	1.1	1.7	0.0	-4.4	-11.8

Velocity, FPS			2100	1969	1843	1723	1609	1502
Energy, Ft-Lb Per Grain			9.79	8.61	7.54	6.59	5.75	5.01
Time of Flight, Seconds			0.0000	0.0738	0.1525	0.2367	0.3268	0.4234
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-4.1	-10.3	-19.9
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-2.9	-8.8	-18.0
Line of Sight	O	150 YDS	-1.5	1.4	2.0	0.0	-4.9	-13.1

Velocity, FPS			2000	1873	1751	1636	1527	1425
Energy, Ft-Lb Per Grain			8.88	7.79	6.81	5.94	5.18	4.51
Time of Flight, Seconds			0.0000	0.0775	0.1603	0.2490	0.3439	0.4457
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-4.9	-11.9	-22.7
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.3	-9.9	-20.2
Line of Sight	O	150 YDS	-1 5	1.6	2.2	0.0	-5.5	-14.7

Velocity, FPS			1900	1777	1660	1550	1447	1351
Energy, Ft-Lb Per Grain			8.01	7.01	6.12	5.33	4.65	4.05
Time of Flight, Seconds			0.0000	0.0816	0.1690	0.2625	0.3627	0.4700
Bullet Path	Z	50 YDS	-1.5	0.0	-1.3	-5.7	-13.7	-25.9
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.8	-11.2	-22.8
Line of Sight	O	150 YDS	-1.5	1.9	2.5	0.0	-6.1	-16.4

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.30

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1800	1682	1570	1466	1369	1281
Energy, Ft-Lb Per Grain			7.19	6.28	5.47	4.77	4.16	3.64
Time of Flight, Seconds			0.0000	0.0862	0.1785	0.2774	0.3834	0.4967
Bullet Path	ZERO	50 YDS	-1.5	0.0	-1.6	-6.7	-15.8	-29.6
(Inches) +/-		100 YDS	-1.5	0.8	0.0	-4.3	-12.7	-25.7
Line of Sight		150 YDS	-1.5	2.2	2.9	0.0	-6.9	-18.5
Velocity, FPS			1700	1587	1482	1383	1294	1215
Energy, Ft-Lb Per Grain			6.42	5.59	4.88	4.25	3.72	3.28
Time of Flight, Seconds			0.0000	0.0913	0.1892	0.2940	0.4061	0.5258
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.0	-7.9	-18.3	-34.0
(Inches) +/-		100 YDS	-1.5	1.0	0.0	-4.9	-14.4	-29.1
Line of Sight		150 YDS	-1.5	2.6	3.3	0.0	-7.8	-20.9
Velocity, FPS			1600	1493	1394	1304	1224	1155
Energy, Ft-Lb Per Grain			5.68	4.95	4.31	3.78	3.33	2.96
Time of Flight, Seconds			0.0000	0.0971	0.2010	0.3123	0.4311	0.5574
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.4	-9.3	-21.3	-39.1
(Inches) +/-		100 YDS	-1.5	1.2	0.0	-5.7	-16.5	-33.1
Line of Sight		150 YDS	-1.5	3.1	3.8	0.0	-8.9	-23.6
Velocity, FPS			1500	1400	1309	1229	1159	1101
Energy, Ft-Lb Per Grain			5.00	4.35	3.80	3.35	2.98	2.69
Time of Flight, Seconds			0.0000	0.1035	0.2143	0.3327	0.4585	0.5914
Bullet Path	ZERO	50 YDS	-1.5	0.0	-2.9	-10.9	-24.7	-44.5
(Inches) +/-		100 YDS	-1.5	1.5	0.0	-6.5	-18.8	-37.6
Line of Sight		150 YDS	-1.5	3.6	4.4	0.0	-10.1	-26.7
Velocity, FPS			1400	1309	1228	1159	1101	1053
Energy, Ft-Lb Per Grain			4.35	3.80	3.35	2.98	2.69	2.46
Time of Flight, Seconds			0.0000	0.1108	0.2292	0.3550	0.4880	0.6274
Bullet Path	ZERO	50 YDS	-1.5	0.0	-3.6	-12.9	-28.7	-51.7
(Inches) +/-		100 YDS	-1.5	1.8	0.0	-7.5	-21.6	-42.8
Line of Sight		150 YDS	-1.5	4.3	5.0	0.0	-11.5	-30.2
Velocity, FPS			1300	1220	1152	1095	1048	1008
Energy, Ft-Lb Per Grain			3.75	3.30	2.95	2.66	2.44	2.26
Time of Flight, Seconds			0.0000	0.1192	0.2458	0.3794	0.5195	0.6656
Bullet Path	ZERO	50 YDS	-1.5	0.0	-4.3	-15.2	-33.3	-59.4
(Inches) +/-		100 YDS	-1.5	2.2	0.0	-8.7	-24.7	-48.5
Line of Sight		150 YDS	-1.5	5.1	5.8	0.0	-13.1	-34.0
Velocity, FPS			1200	1135	1081	1036	998	966
Energy, Ft-Lb Per Grain			3.20	2.86	2.59	2.38	2.21	2.07
Time of Flight, Seconds			0.0000	0.1286	0.2642	0.4060	0.5535	0.7064
Bullet Path	ZERO	50 YDS	-1.5	0.0	-5.2	-17.9	-38.7	-68.2
(Inches) +/-		100 YDS	-1.5	2.6	0.0	-10.1	-28.2	-55.1
Line of Sight		150 YDS	-1.5	6.0	6.7	0.0	-14.8	-38.3

SPEER

SHORT RANGE TABLES

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.30

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1100	1052	1012	978	947	920
Energy, Ft-Lb Per Grain			2.69	2.46	2.27	2.12	1.99	1.88
Time of Flight, Seconds			0.0000	0.1395	0.2850	0.4359	0.5918	0.7526
Bullet Path	Z	50 YDS	-1.5	0.0	-6.3	-21.2	-45.1	-78.7
(Inches) +/-	E R	100 YDS	-1.5	3.2	0.0	-11.7	-32.4	-62.8
Line of Sight	O	150 YDS	-1.5	7.1	7.8	0.0	-16.9	-43.4
Velocity, FPS			1000	967	938	912	888	865
Energy, Ft-Lb Per Grain			2.22	2.08	1.95	1.85	1.75	1.66
Time of Flight, Seconds			0.0000	0.1526	0.3102	0.4724	0.6393	0.8105
Bullet Path	Z	50 YDS	-1.5	0.0	-7.8	-25.4	-53.6	-92.7
(Inches) +/-	E R	100 YDS	-1.5	3.9	0.0	-13.8	-38.0	-73.3
Line of Sight	O	150 YDS	-1.5	8.5	9.2	0.0	-19.7	-50.3

Exterior Ballistic Table for Ballistic Coefficient 0.32

Velocity, FPS			2400	2267	2139	2014	1894	1779
Energy, Ft-Lb Per Grain			12.79	11.41	10.16	9.01	7.96	7.03
Time of Flight, Seconds			0.0000	0.0643	0.1324	0.2047	0.2815	0.3632
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.3	-6.5	-13.2
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-2.0	-6.1	-12.7
Line of Sight	O	150 YDS	-1.5	0.8	1.3	0.0	-3.5	-9.4
Velocity, FPS			2300	2170	2045	1924	1807	1696
Energy, Ft-Lb Per Grain			11.74	10.45	9.28	8.22	7.25	6.39
Time of Flight, Seconds			0.0000	0.0671	0.1383	0.2140	0.2944	0.3801
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-2.8	-7.6	-15.0
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.3	-6.9	-14.1
Line of Sight	O	150 YDS	-1.5	0.9	1.5	0.0	-3.9	-10.4
Velocity, FPS			2200	2074	1951	1834	1721	1614
Energy, Ft-Lb Per Grain			10.75	9.55	8.45	7.47	6.58	5.78
Time of Flight, Seconds			0.0000	0.0702	0.1448	0.2241	0.3085	0.3985
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.3	-8.7	-17.1
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.5	-7.7	-15.7
Line of Sight	O	150 YDS	-1.5	1.1	1.7	0.0	-4.3	-11.5
Velocity, FPS			2100	1977	1858	1745	1637	1534
Energy, Ft-Lb Per Grain			9.79	8.68	7.66	6.76	5.95	5.22
Time of Flight, Seconds			0.0000	0.0736	0.1519	0.2352	0.3240	0.4186
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-4.0	-10.1	-19.4
(Inches) +/-	E R	100 YDS	-1.5	0.4	0.0	-2.9	-8.6	-17.6
Line of Sight	O	150 YDS	-1.5	1.3	1.9	0.0	-4.8	-12.8
Velocity, FPS			2000	1881	1766	1657	1553	1456
Energy, Ft-Lb Per Grain			8.88	7.85	6.92	6.10	5.35	4.71
Time of Flight, Seconds			0.0000	0.0773	0.1597	0.2474	0.3409	0.4407
Bullet Path	Z	50 YDS	-1.5	0.0	-1.0	-4.7	-11.6	-22.2
(Inches) + /-	E R	100 YDS	-1.5	0.5	0.0	-3.3	-9.7	-19.8
Line of Sight	O	150 YDS	-1.5	1.6	2.2	0.0	-5.3	-14.3

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.32

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			1900	1785	1674	1570	1472	1380
Energy, Ft-Lb Per Grain			8.01	7.07	6.22	5.47	4.81	4.23
Time of Flight, Seconds			0.0000	0.0815	0.1683	0.2608	0.3595	0.4648
Bullet Path	Z	50 YDS	-1.5	0.0	-1.2	-5.6	-13.4	-25.3
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.7	-11.0	-22.2
Line of Sight	O	150 YDS	-1.5	1.9	2.5	0.0	-6.0	-16.0
Velocity, FPS			1800	1689	1584	1485	1392	1307
Energy, Ft-Lb Per Grain			7.19	6.33	5.57	4.90	4.30	3.79
Time of Flight, Seconds			0.0000	0.0860	0.1778	0.2756	0.3800	0.4912
Bullet Path	Z	50 YDS	-1.5	0.0	-1.5	-6.6	-15.5	-29.0
(Inches) +/-	E R	100 YDS	-1.5	0.8	0.0	-4.2	-12.4	-25.1
Line of Sight	O	150 YDS	-1.5	2.2	2.8	0.0	-6.8	-18.0
Velocity, FPS			1700	1594	1494	1401	1316	1239
Energy, Ft-Lb Per Grain			6.42	5.64	4.96	4.36	3.84	3.41
Time of Flight, Seconds			0.0000	0.0911	0.1883	0.2920	0.4025	0.5201
Bullet Path	Z	50 YDS	-1.5	0.0	-1.9	-7.7	-18.0	-33.3
(Inches) +/-	E R	100 YDS	-1.5	1.0	0.0	-4.9	-14.1	-28.5
Line of Sight	O	150 YDS	-1.5	2.6	3.2	0.0	-7.7	-20.4
Velocity, FPS			1600	1500	1406	1320	1243	1175
Energy, Ft-Lb Per Grain			5.68	5.00	4.39	3.87	3.43	3.07
Time of Flight, Seconds			0.0000	0.0968	0.2002	0.3103	0.4274	0.5516
Bullet Path	Z	50 YDS	-1.5	0.0	-2.4	-9.1	-20.9	-38.3
(Inches) +/-	E R	100 YDS	-1.5	1.2	0.0	-5.6	-16.2	-32.3
Line of Sight	O	150 YDS	-1.5	3.0	3.7	0.0	-8.7	-23.0
Velocity, FPS			1500	1406	1320	1243	1175	1118
Energy, Ft-Lb Per Grain			5.00	4.39	3.87	3.43	3.07	2.77
Time of Flight, Seconds			0.0000	0.1033	0.2134	0.3306	0.4548	0.5857
Bullet Path	Z	50 YDS	-1.5	0.0	-2.9	-10.8	-24.3	-44.1
(Inches) +/-	E R	100 YDS	-1.5	1.4	0.0	-6.4	-18.5	-36.9
Line of Sight	O	150 YDS	-1.5	3.6	4.3	0.0	-9.9	-26.1

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2900	2778	2659	2543	2431	2321
Energy, Ft-Lb Per Grain			18.67	17.13	15.70	14.36	13.12	11.96
Time of Flight, Seconds			0.0000	0.0528	0.1080	0.1657	0.2260	0.2892
Bullet Path	Z	50 YDS	-1.5	0.0	0.4	-0.5	-2.7	-6.4
(Inches) +/-	E R	100 YDS	-1.5	-0.2	0.0	-1.0	-3.4	-7.3
Line of Sight	O	150 YDS	-1.5	0.2	0.7	0.0	-2.0	-5.5
Velocity, FPS			2800	2681	2564	2451	2341	2233
Energy, Ft-Lb Per Grain			17.41	15.96	14.59	13.34	12.17	11.07
Time of Flight, Seconds			0.0000	0.0548	0.1120	0.1718	0.2344	0.3000
Bullet Path	Z	50 YDS	-1.5	0.0	0.3	-0.7	-3.2	-7.3
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.2	-3.8	-8.0
Line of Sight	O	150 YDS	-1.5	0.2	0.8	0.0	-2.2	-6.1

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2700	2583	2469	2359	2250	2145
Energy, Ft-Lb Per Grain			16.18	14.81	13.53	12.35	11.24	10.21
Time of Flight, Seconds			0.0000	0.0568	0.1162	0.1783	0.2435	0.3117
Bullet Path	Z	50 YDS	-1.5	0.0	0.2	-1.0	-3.8	-8.3
(Inches) +/-	E R	100 YDS	-1.5	-0.1	0.0	-1.3	-4.2	-8.8
Line of Sight	O	150 YDS	-1.5	0.3	0.9	0.0	-2.4	-6.6
Velocity, FPS			2600	2486	2374	2266	2160	2057
Energy, Ft-Lb Per Grain			15.01	13.72	12.51	11.40	10.36	9.39
Time of Flight, Seconds			0.0000	0.0590	0.1207	0.1854	0.2532	0.3244
Bullet Path	Z	50 YDS	-1.5	0.0	0.1	-1.4	-4.5	-9.5
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.5	-4.7	-9.7
Line of Sight	O	150 YDS	-1.5	0.5	1.0	0.0	-2.7	-7.2
Velocity, FPS			2500	2388	2279	2173	2070	1969
Energy, Ft-Lb Per Grain			13.88	12.66	11.53	10.48	9.51	8.61
Time of Flight, Seconds			0.0000	0.0614	0.1257	0.1931	0.2638	0.3381
Bullet Path	Z	50 YDS	-1.5	0.0	0.0	-1.7	-5.3	-10.8
(Inches) +/-	E R	100 YDS	-1.5	0.0	0.0	-1.7	-5.2	-10.8
Line of Sight	O	150 YDS	-1.5	0.6	1.1	0.0	-3.0	-8.0
Velocity, FPS			2400	2291	2184	2081	1980.	1882
Energy, Ft-Lb Per Grain			12.79	11.65	10.59	9.61	8.70	7.86
Time of Flight, Seconds			0.0000	0.0640	0.1310	0.2014	0.2753	0.3530
Bullet Path	Z	50 YDS	-1.5	0.0	-0.2	-2.1	-6.1	-12.3
(Inches) +/-	E R	100 YDS	-1.5	0.1	0.0	-1.9	-5.8	-11.9
Line of Sight	O	150 YDS	-1.5	0.7	1.3	0.0	-3.3	-8.8
Velocity, FPS			2300	2193	2089	1988	1890	1796
Energy, Ft-Lb Per Grain			11.74	10.68	9.69	8.77	7.93	7.16
Time of Flight, Seconds			0.0000	0.0668	0.1369	0.2104	0.2878	0.3692
Bullet Path	Z	50 YDS	-1.5	0.0	-0.3	-2.6	-7.1	-14.0
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.1	-6.5	-13.3
Line of Sight	O	150 YDS	-1.5	0.9	1.4	0.0	-3.6	-9.7
Velocity, FPS			2200	2096	1995	1897	1802	1710
Energy, Ft-Lb Per Grain			10.75	9.75	8.84	7.99	7.21	6.49
Time of Flight, Seconds			0.0000	0.0699	0.1432	0.2203	0.3015	0.3870
Bullet Path	Z	50 YDS	-1.5	0.0	-0.5	-3.1	-8.2	-16.0
(Inches) +/-	E R	100 YDS	-1.5	0.2	0.0	-2.4	-7.3	-14.8
Line of Sight	O	150 YDS	-1.5	1.0	1.6	0.0	-4.0	-10.7
Velocity, FPS			2100	1999	1900	1805	1714	1626
Energy, Ft-Lb Per Grain			9.79	8.87	8.01	7.23	6.52	5.87
Time of Flight, Seconds			0.0000	0.0732	0.1502	0.2312	0.3165	0.4063
Bullet Path	Z	50 YDS	-1.5	0.0	-0.7	-3.8	-9.5	-18.2
(Inches) +/-	E R	100 YDS	-1.5	0.3	0.0	-2.7	-8.2	-16.5
Line of Sight	O	150 YDS	-1.5	1.3	1.8	0.0	-4.5	-12.0

SHORT RANGE TABLES SPEER

50 to 250 yards

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE			MUZZLE	50 YDS	100 YDS	150 YDS	200 YDS	250 YDS
Velocity, FPS			2000	1902	1807	1715	1627	1543
Energy, Ft-Lb Per Grain			8.88	8.03	7.25	6.53	5.88	5.29
Time of Flight, Seconds			0.0000	0.0769	0.1578	0.2431	0.3329	0.4276
Bullet Path	Z	50 YDS	-1.5	0.0	-0.9	-4.5	-11.0	-20.8
(Inches) +/-	E R	100 YDS	-1.5	0.5	0.0	-3.1	-9.2	-18.5
Line of Sight	O	150 YDS	-1.5	1.5	2.1	0.0	-5.0	-13.4
Velocity, FPS			1900	1805	1713	1625	1542	1462
Energy, Ft-Lb Per Grain			8.01	7.23	6.51	5.86	5.28	4.75
Time of Flight, Seconds			0.0000	0.0810	0.1663	0.2562	0.3510	0.4509
Bullet Path	Z	50 YDS	-1.5	0.0	-1.2	-5.3	-12.7	-23.8
(Inches) +/-	E R	100 YDS	-1.5	0.6	0.0	-3.5	-10.4	-20.9
Line of Sight	O	150 YDS	-1.5	1.8	2.4	0.0	-5.7	-15.0
Velocity, FPS			1800	1709	1621	1537	1458	1383
Energy, Ft-Lb Per Grain			7.19	6.48	5.83	5.24	4.72	4.25
Time of Flight, Seconds			0.0000	0.0855	0.1757	0.2707	0.3709	0.4766
Bullet Path	Z	50 YDS	-1.5	0.0	-1.5	-6.3	-14.7	-27.3
(Inches) +/-	E R	100 YDS	-1.5	0.7	0.0	-4.0	-11.8	-23.6
Line of Sight	O	150 YDS	-1.5	2.1	2.7	0.0	-6.4	-16.8
Velocity, FPS			1700	1613	1529	1450	1376	1307
Energy, Ft-Lb Per Grain			6.42	5.78	5.19	4.67	4.20	3.79
Time of Flight, Seconds			0.0000	0.0906	0.1861	0.2868	0.3930	0.5049
Bullet Path	Z	50 YDS	-1.5	0.0	-1.8	-7.4	-17.1	-31 4
(Inches) +/-	E R	100 YDS	-1.5	0.9	0.0	-4.6	-13.4	-26.8
Line of Sight	O	150 YDS	-1.5	2.5	3.1	0.0	-7.2	-19.0
Velocity, FPS			1600	1517	1439	1366	1297	1235
Energy, Ft-Lb Per Grain			5.68	5.11	4.60	4.14	3.73	3.39
Time of Flight, Seconds			0.0000	0.0963	0.1978	0.3048	0.4176	0.5361
Bullet Path	Z	50 YDS	-1.5	0.0	-2.3	-8.8	-19.9	-36.2
(Inches) +/-	E R	100 YDS	-1.5	1.1	0.0	-5.3	-15.3	-30.5
Line of Sight	O	150 YDS	-1.5	2.9	3.6	0.0	-8.2	-21.6
Velocity, FPS			1500	1423	1350	1283	1223	1169
Energy, Ft-Lb Per Grain			5.00	4.50	4.05	3.65	3.32	3.03
Time of Flight, Seconds			0.0000	0.1027	0.2109	0.3249	0.4447	0.5702
Bullet Path	Z	50 YDS	-1.5	0.0	-2.8	-10.4	-23.2	-41.9
(Inches) +/-	E R	100 YDS	-1.5	1.4	0.0	-6.2	-17.6	-34.9
Line of Sight	O	150 YDS	-1.5	3.5	4.1	0.0	-9.4	-24.6

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			4000	3185	2505	1917	1432	1103
Energy, Ft-Lb Per Grain			35.52	22.52	13.93	8.16	4.55	2.70
Tirne of Flight, Seconds			0.0000	0.0842	0.1905	0.3274	0.5089	0.7502
Bullet Path	Z	100 YDS	-1.5	0.0	-2.0	-9.7	-27.1	-61.9
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-6.7	-23.1	-56.9
Line of Sight	O	300 YDS	-1.5	3.2	4.5	0.0	-14.2	-45.8
Velocity, FPS			3900	3103	2434	1857	1386	1078
Energv, Ft-Lb Per Grain			33.77	21.38	13.15	7.66	4.26	2.58
Time of Flight, Seconds			0.0000	0.0864	0.1956	0.3368	0.5244	0.7726
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-10.4	-29.0	-66.1
(Inches) + /-	E R	200 YDS	-1.5	1.1	0.0	-7.1	-24.6	-60.6
Line of Sight	O	300 YDS	-1.5	3.5	4.7	0.0	-15.1	-48.7
Velocity, FPS			3800	3021	2363	1797	1340	1056
Energy, Ft-Lb Per Grain			32.06	20.26	12.40	7.17	3.99	2.48
Time of Flight, Seconds			0.0000	0.0887	0.2010	0.3467	0.5407	0.7960
Bullet Path	Z	100 YDS	-1.5	0.0	-2.4	-11.2	-31.1	-70.6
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-7.6	-26.3	-64.7
Line of Sight	O	300 YDS	-1.5	3.7	5.1	0.0	-16.2	-52.0
Velocity, FPS			3700	2938	2292	1736	1296	1034
Energy, Ft-Lb Per Grain			30.39	19.16	11.66	6.69	3.73	2.37
Time of Flight, Seconds			0.0000	0.0911	0.2068	0.3573	0.5581	0.8204
Bullet Path	Z	100 YDS	-1.5	0.0	-2.6	-12.0	-33.3	-75.6
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-8.1	-28.1	-69.1
Line of Sight	O	300 YDS	-1.5	4.0	5.4	0.0	-17.3	-55.5
Velocity, FPS			3600	2855	2220	1676	1254	1014
Energy, Ft-Lb Per Grain			28.77	18.10	10.94	6.24	3.49	2.28
Time of Flight, Seconds			0.0000	0.0937	0.2129	0.3686	0.5766	0.8459
Bullet Path	Z	100 YDS	-1.5	0.0	-2.9	-13.0	-35.9	-81.0
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-8.7	-30.1	-73.9
Line of Sight	O	300 YDS	-1.5	4.3	5.8	0.0	-18.5	-59.4
Velocity, FPS			3500	2771	2147	1616	1213	995
Energy, Ft-Lb Per Grain			27.20	17.05	10.23	5.80	3.27	2.20
Time of Flight, Seconds			0.0000	0.0964	0.2195	0.3807	0.5963	0.8724
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-14.0	-38.6	-86.9
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-9.3	-32.4	-79.1
Line of Sight	O	300 YDS	-1.5	4.7	6.2	0.0	-19.9	-63.5
Velocity, FPS			3400	2687	2074	1557	1175	977
Energy, Ft-Lb Per Grain			25.66	16.03	9.55	5.38	3.07	2.12
Time of Flight, Seconds			0.0000	0.0994	0.2265	0.3937	0.6172	0.9000
Bullet Path	Z	100 YDS	-1.5	0.0	-3.4	-15.2	-41.7	-93.4
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-10.0	-34.8	-84.8
Line of Sight	O	300 YDS	-1.5	5.1	6.7	0.0	-21.4	-68.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3300	2602	2001	1498	1140	960
Energy, Ft-Lb Per Grain		24.18	15.03	8.89	4.98	2.89	2.05
Time of Flight, Seconds		0.0000	0.1025	0.2340	0.4076	0.6392	0.9287
Bullet Path	Z 100 YDS	-1.5	0.0	-3.8	-16.5	-45.1	-100.3
(Inches) +/-	E 200 YDS	-1.5	1.9	0.0	-10.8	-37.6	-90.9
Line of Sight	R O 300 YDS	-1.5	5.5	7.2	0.0	-23.1	-72.9
Velocity, FPS		3200	2517	1928	1440	1107	943
Energy, Ft-Lb Per Grain		22.73	14.06	8.25	4.60	2.72	1.97
Time of Flight, Seconds		0.0000	0.1058	0.2420	0.4225	0.6625	0.9584
Bullet Path	Z 100 YDS	-1.5	0.0	-4.1	-17.9	-48.8	-108.0
(Inches) +/-	E 200 YDS	-1.5	2.1	0.0	-11.7	-40.6	-97.6
Line of Sight	R O 300 YDS	-1.5	6.0	7.8	0.0	-25.0	-78.1
Velocity, FPS		3100	2431	1855	1384	1077	927
Energy, Ft-Lb Per Grain		21.33	13.12	7.64	4.25	2.58	1.91
Time of Flight, Seconds		0.0000	0.1093	0.2507	0.4385	0.6870	0.9892
Bullet Path	Z 100 YDS	-1.5	0.0	-4.5	-19.5	-53.0	-116.2
(Inches) +/-	E 200 YDS	-1.5	2.3	0.0	-12.7	-43.9	-104.9
Line of Sight	R O 300 YDS	-1.5	6.5	8.5	0.0	-27.0	-83.7
Velocity, FPS		3000	2345	1781	1329	1050	912
Energy, Ft-Lb Per Grain		19.98	12.21	7.04	3.92	2.45	1.85
Time of Flight, Seconds		0.0000	0.1132	0.2600	0.4557	0.7127	1.0212
Bullet Path	Z 100 YDS	-1.5	0.0	-5.0	-21.3	-57.6	-125.2
(Inches) +/-	E 200 YDS	-1.5	2.5	0.0	-13.8	-47.6	-112.7
Line of Sight	R O 300 YDS	-1.5	7.1	9.2	0.0	-29.2	-89.7
Velocity, FPS		2900	2259	1709	1277	1025	897
Energy, Ft-Lb Per Grain		18.67	11.33	6.48	3.62	2.33	1.79
Time of Flight, Seconds		0.0000	0.1173	0.2701	0.4742	0.7396	1.0541
Bullet Path	Z 100 YDS	-1.5	0.0	-5.5	-23.3	-42.6	-134.9
(Inches) +/-	E 200 YDS	-1.5	2.8	0.0	-15.0	-51.6	-121.1
Line of Sight	R O 300 YDS	-1.5	7.8	10.0	0.0	-31.6	-96.1
Velocity, FPS		2800	2173	1637	1227	1001	882
Energy, Ft-Lb Per Grain		17.41	10.48	5.95	3.34	2.22	1.73
Time of Flight, Seconds		0.0000	0.1217	0.2809	0.4939	0.7676	1.0882
Bullet Path	Z 100 YDS	-1.5	0.0	-6.1	-25.5	-48.2	-145.3
(Inches) +/-	E 200 YDS	-1.5	3.0	0.0	-16.4	-56.0	-130.1
Line of Sight	R O 300 YDS	-1.5	8.5	10.9	0.0	-34.1	-102.8
Velocity, FPS		2700	2086	1566	1181	980	868
Energy, Ft-Lb Per Grain		16.18	9.66	5.44	3.10	2.13	1.67
Time of Flight, Seconds		0.0000	0.1264	0.2927	0.5149	0.7967	1.1233
Bullet Path	Z 100 YDS	-1.5	0.0	-6.7	-28.0	-74.3	-156.6
(Inches) +/-	E 200 YDS	-1.5	3.4	0.0	-17.9	40.8	-139.8
Line of Sight	R O 300 YDS	-1.5	9.3	12.0	0.0	-36.9	-109.9

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2600	2000	1497	1139	959	854
Energy, Ft-Lb Per Grain		15.01	8.88	4.98	2.88	2.04	1.62
Time of Flight, Seconds		0.0000	0.1316	0.3054	0.5372	0.8269	1.1594
Bullet Path	Z 100 YDS	-1.5	0.0	-7.5	-30.9	-81.0	-168.7
(Inches) +/-	E R 200 YDS	-1.5	3.7	0.0	-19.7	-66.0	-150.1
Line of Sight	O 300 YDS	-1.5	10.3	13.1	0.0	-39.8	-117.3
Velocity, FPS		2500	1913	1429	1101	940	840
Energy, Ft-Lb Per Grain		13.88	8.12	4.53	2.69	1.96	1.57
Time of Flight, Seconds		0.0000	0.1372	0.3191	0.5608	0.8580	1.1966
Bullet Path	Z 100 YDS	-1.5	0.0	-8.3	-34.0	-88.2	-181.7
(Inches) +/-	E R 200 YDS	-1.5	4.1	0.0	-21.6	-71.6	-161.0
Line of Sight	O 300 YDS	-1.5	11.3	14.4	0.0	-42.9	-125.1
Velocity, FPS		2400	1828	1363	1067	921	826
Energy, Ft-Lb Per Grain		12.79	7.42	4.12	2.53	1.88	1.51
Time of Flight, Seconds		0.0000	0.1433	0.3340	0.5856	0.8901	1.2348
Bullet Path	Z 100 YDS	-1.5	0.0	-9.2	-37.5	-96.1	-195.6
(Inches) +/-	E R 200 YDS	-1.5	4.6	0.0	-23.7	-77.7	-172.6
Line of Sight	O 300 YDS	-1.5	12.5	15.8	0.0	-46.1	-133.1
Velocity, FPS		2300	1743	1301	1037	904	813
Energy, Ft-Lb Per Grain		11.74	6.74	3.76	2.39	1.81	1.47
Time of Flight, Seconds		0.0000	0.1499	0.3500	0.6115	0.9231	1.2739
Bullet Path	Z 100 YDS	-1.5	0.0	-10.3	-41.4	-104.7	-210.5
(Inches) +/-	E R 200 YDS	-1.5	5.1	0.0	-25.9	-84.1	-184.8
Line of Sight	O 300 YDS	-1.5	13.8	17.3	0.0	-49.5	-141.5
Velocity, FPS		2200	1660	1243	1009	887	800
Energy, Ft-Lb Per Grain		10.75	6.12	3.43	2.26	1.75	1.42
Time of Flight, Seconds		0.0000	0.1572	0.3672	0.6384	0.9570	1.3142
Bullet Path	Z 100 YDS	-1.5	0.0	-11.5	-45.7	-113.9	-226.3
(Inches) +/-	E R 200 YDS	-1.5	5.8	0.0	-28.4	-90.9	-197.6
Line of Sight	O 300 YDS	-1.5	15.2	18.9	0.0	-53.0	-150.2
Velocity, FPS		2100	1577	1188	983	870	786
Energy, Ft-Lb Per Grain		9.79	5.52	3.13	2.15	1.68	1.37
Time of Flight, Seconds		0.0000	0.1651	0.3858	0.6663	0.9919	1.3554
Bullet Path	Z 100 YDS	-1.5	0.0	-12.9	-50.4	-123.8	-243.1
(Inches) +/-	E R 200 YDS	-1.5	6.4	0.0	-31.1	-98.0	-211.0
Line of Sight	O 300 YDS	-1.5	16.8	20.7	0.0	-56.6	-159.1
Velocity, FPS		2000	1497	1139	959	854	773
Energy, Ft-Lb Per Grain		8.88	4.98	2.88	2.04	1.62	1.33
Time of Flight, Seconds		0.0000	0.1737	0.4055	0.6951	1.0276	1.3976
Bullet Path	Z 100 YDS	-1.5	0.0	-14.4	-55.5	-134.3	-260.9
(Inches) +/-	E R 200 YDS	-1.5	7.2	0.0	-33.9	-105.5	-224.9
Line of Sight	O 300 YDS	-1.5	18.5	22.6	0.0	-60.3	-168.3

Exterior Ballistic Table for Ballistic Coefficient 0.14

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		1900	1418	1096	937	838	760
Energy, Ft-Lb Per Grain		8.01	4.46	2.67	1.95	1.56	1.28
Time of Flight, Seconds		0.0000	0.1832	0.4265	0.7248	1.0644	1.4411
Bullet Path	Z 100 YDS	-1.5	0.0	-16.2	-61.1	-145.6	-279.8
(Inches) +/-	E R 200 YDS	-1.5	8.1	0.0	-36.9	-113.3	-239.4
Line of Sight	O 300 YDS	-1.5	20.4	24.6	0.0	-64.2	-177.9
Velocity, FPS		1800	1343	1057	916	822	747
Energy, Ft-Lb Per Grain		7.19	4.00	2.48	1.86	1.50	1.24
Time of Flight, Seconds		0.0000	0.1937	0.4485	0.7553	1.1021	1.4859
Bullet Path	Z 100 YDS	-1.5	0.0	-18.1	-67.1	-157.7	-299.8
(Inches) +/-	E R 200 YDS	-1.5	9.1	0.0	-40.0	-121.5	-254.6
Line of Sight	O 300 YDS	-1.5	22.4	26.7	0.0	-68.1	-187.9
Velocity, FPS		1700	1270	1022	895	806	733
Energy Ft-Lb Per Grain		6.42	3.58	2.32	1.78	1.44	1.19
Time of Flight, Seconds		0.0000	0.2051	0.4716	0.7868	1.1409	1.5319
Bullet Path	Z 100 YDS	-1.5	0.0	-20.2	-73.6	-170.4	-320.9
(Inches) +/-	E R 200 YDS	-1.5	10.1	0.0	-43.2	-129.9	-270.3
Line of Sight	O 300 YDS	-1.5	24.5	28.8	0.0	-72.3	-198.2
Velocity, FPS		1600	1203	990	875	790	720
Energy, Ft-Lb Per Grain		5.68	3.21	2.18	1.70	1.39	1.15
Time of Flight, Seconds		0.0000	0.2177	0.4956	0.8193	1.1811	1.5796
Bullet Path	Z 100 YDS	-1.5	0.0	-22.6	-80.5	-184.0	-343.2
(Inches) +/-	E R 200 YDS	-1.5	11.3	0.0	-46.6	-138.8	-286.7
Line of Sight	O 300 YDS	-1.5	26.8	31.1	0.0	-76.6	-209.0
Velocity, FPS		1500	1141	960	854	774	705
Energy, Ft-Lb Per Grain		5.00	2.89	2.05	1.62	1.33	1.10
Time of Flight, Seconds		0.0000	0.2313	0.5205	0.8528	1.2225	1.6296
Bullet Path	Z 100 YDS	-1.5	0.0	-25.1	-87.8	-198.3	-367.1
(Inches) +/-	E R 200 YDS	-1.5	12.6	0.0	-50.2	-148.0	-304.3
Line of Sight	O 300 YDS	-1.5	29.3	33.4	0.0	-81.1	-220.7

Exterior Ballistic Table for Ballistic Coefficient 0.17

Velocity, FPS		4200	3487	2879	2347	1876	1474
Energy, Ft-Lb Per Grain		39.16	26.99	18.40	12.23	7.81	4.82
Time of Flight, Seconds		0.0000	0.0785	0.1732	0.2887	0.4317	0.6124
Bullet Path	Z 100 YDS	-1.5	0.0	-1.4	-7.0	-19.1	-41.3
(Inches) +/-	E R 200 YDS	-1.5	0.7	0.0	-5.0	-16.3	-37.8
Line of Sight	O 300 YDS	-1.5	2.3	3.3	0.0	-9.7	-29.5
Velocity, FPS		4100	3403	2806	2283	1819	1429
Energy, Ft-Lb Per Grain		37.32	25.71	17.48	11.57	7.35	4.53
Time of Flight, Seconds		0.0000	0.0804	0.1776	0.2961	0.4434	0.6299
Pullet Path	Z 100 YDS	-1.5	0.0	-1.5	-7.6	-20.4	-43.9
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-5.3	-17.3	-40.1
Line of Sight	O 300 YDS	-1.5	2.5	3.5	0.0	-10.3	-31.3

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		4000	3318	2733	2217	1762	1383
Energy, Ft-Lb Per Grain		35.52	24.44	16.58	10.91	6.89	4.25
Time of Flight, Seconds		0.0000	0.0824	0.1821	0.3040	0.4559	0.6485
Bullet Path	Z 100 YDS	-1.5	0.0	-1.7	-8.1	-21.8	-46.8
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-5.6	-18.4	-42.6
Line of Sight	O 300 YDS	-1.5	2.7	3.7	0.0	-10.9	-33.3
Velocity, FPS		3900	3233	2659	2151	1706	1339
Energy, Ft-Lb Per Grain		33.77	23.20	15.70	10.27	6.46	3.98
Time of Flight, Seconds		0.0000	0.0846	0.1870	0.3124	0.4691	0.6682
Bullet Path	Z 100 YDS	-1.5	0.0	-1.9	-8.7	-23.3	-50.0
(Inches) +/-	E R 200 YDS	-1.5	0.9	0.0	-5.9	-19.5	-45.3
Line of Sight	O 300 YDS	-1.5	2.9	4.0	0.0	-11.6	-35.4
Velocity, FPS		3800	3148	2584	2085	1649	1296
Energy, Ft-Lb Per Grain		32.06	22.00	14.82	9.65	6.04	3.73
Time of Flight, Seconds		0.0000	0.0868	0.1921	0.3213	0.4832	0.6891
Bullet Path	Z 100 YDS	-1.5	0.0	-2.1	-9.4	-24.9	-53.5
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-6.3	-20.8	-48.3
Line of Sight	O 300 YDS	-1.5	3.1	4.2	0.0	-12.4	-37.8
Velocity, FPS		3700	3063	2509	2019	1593	1255
Energy, Ft-Lb Per Grain		30.39	20.83	13.98	9.05	5.63	3.50
Time of Flight, Seconds		0.0000	0.0892	0.1975	0.3308	0.4983	0.7113
Bullet Path	Z 100 YDS	-1.5	0.0	-2.3	-10.1	-26.7	-57.3
(Inches) +/-	E R 100 YDS	-1.5	1.1	0.0	-6.7	-22.2	-51.6
Line of Sight	O 300 YDS	-1.5	3.4	4.5	0.0	-13.2	-40.4
Velocity, FPS		3600	2977	2434	1952	1537	1215
Energy, Ft-Lb Per Grain		28.77	19.68	13.15	8.46	5.24	3.28
Time of Flight, Seconds		0.0000	0.0917	0.2032	0.3409	0.5144	0.7349
Bullet Path	Z 100 YDS	-1.5	0.0	-2.5	-10.9	-28.7	-61.5
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-7.2	-23.7	-55.3
Line of Sight	O 300 YDS	-1.5	3.6	4.8	0.0	-14.1	-43.2
Velocity, FPS		3500	2891	2357	1885	1482	1178
Energy, Ft-Lb Per Grain		27.20	18.56	12.33	7.89	4.88	3.08
Time of Flight, Seconds		0.0000	0.0944	0.2093	0.3517	0.5316	0.7599
Bullet Path	Z 100 YDS	-1.5	0.0	-2.7	-11.8	-30.9	-66.1
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-7.7	-25.5	-59.3
Line of Sight	O 300 YDS	-1.5	3.9	5.2	0.0	-15.1	-46.4
Velocity, FPS		3400	2804	2281	1817	1427	1143
Energy, Ft-Lb Per Grain		25.66	17.46	11.55	7.33	4.52	2.90
Time of Flight, Seconds		0.0000	0.0972	0.2159	0.3633	0.5499	0.7864
Bullet Path	Z 100 YDS	-1.5	0.0	-3.0	-12.8	-33.3	-71.2
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-8.3	-27.4	-63.7
Line of Sight	O 300 YDS	-1.5	4.3	5.5	0.0	-16.3	-49.9

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3300	2717	2203	1750	1374	1111
Energy, Ft-Lb Per Grain			24.18	16.39	10.77	6.80	4.19	2.74
Time of Flight, Seconds			0.0000	0.1002	0.2229	0.3757	0.5696	0.8143
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.3	-13.9	-36.0	-76.9
(Inches) +/-		200 YDS	-1.5	1.6	0.0	-8.9	-29.5	-48.7
Line of Sight		300 YDS	-1.5	4.6	6.0	0.0	-17.5	-53.7
Velocity, FPS			3200	2630	2126	1684	1322	1081
Energy, Ft-Lb Per Grain			22.73	15.36	10.03	6.30	3.88	2.59
Time of Flight, Seconds			0.0000	0.1035	0.2304	0.3891	0.5907	0.8437
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.6	-15.1	-39.0	-83.1
(Inches) +/-		200 YDS	-1.5	1.8	0.0	-9.7	-31.8	-74.1
Line of Sight		300 YDS	-1.5	5.0	6.4	0.0	-19.0	-58.0
Velocity, FPS			3100	2542	2048	1617	1273	1054
Energy, Ft-Lb Per Grain			21.33	14.35	9.31	5.80	3.60	2.47
Time of Flight, Seconds			0.0000	0.1069	0.2384	0.4034	0.6133	0.8745
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.0	-16.4	-42.4	-90.0
(Inches) +/-		200 YDS	-1.5	2.0	0.0	-10.4	-34.4	-80.1
Line of Sight		300 YDS	-1.5	5.5	7.0	0.0	-20.5	-62.6
Velocity, FPS			3000	2454	1970	1552	1226	1029
Energy, Ft-Lb Per Grain			19.98	13.37	8.62	5.35	3.34	2.35
Time of Flight, Seconds			0.0000	0.1106	0.2471	0.4189	0.6374	0.9067
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.4	-17.9	-46.1	-97.6
(Inches) +/-		200 YDS	-1.5	2.2	0.0	-11.3	-37.4	-86.6
Line of Sight		300 YDS	-1.5	6.0	7.6	0.0	-22.3	-67.7
Velocity, FPS			2900	2366	1892	1488	1182	1006
Energy, Ft-Lb Per Grain			18.67	12.43	7.95	4.92	3.10	2.25
Time of Flight, Seconds			0.0000	0.1146	0.2564	0.4355	0.6631	0.9403
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.8	-19.6	-50.3	-105.9
(Inches) +/-		200 YDS	-1.5	2.4	0.0	-12.3	-40.6	-93.9
Line of Sight		300 YDS	-1.5	6.5	8.2	0.0	-24.2	-73.3
Velocity, FPS			2800	2277	1814	1425	1142	984
Energy, Ft-Lb Per Grain			17.41	11.51	7.31	4.51	2.90	2.15
Time of Flight, Seconds			0.0000	0.1188	0.2665	0.4535	0.6903	0.9753
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.3	-21.4	-55.0	-115.1
(Inches) +/-		200 YDS	-1.5	2.7	0.0	-13.5	-44.3	-101.8
Line of Sight		300 YDS	-1.5	7.2	9.0	0.0	-26.4	-79.3
Velocity, FPS			2700	2188	1737	1364	1105	964
Energy, Ft-Lb Per Grain			16.18	10.63	6.70	4.13	2.71	2.06
Time of Flight, Seconds			0.0000	0.1235	0.2774	0.4728	0.7191	1.0116
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.9	-23.6	-60.2	-125.1
(Inches) +/-		200 YDS	-1.5	3.0	0.0	-14.7	-48.4	-110.4
Line of Sight		300 YDS	-1.5	7.9	9.8	0.0	-28.7	-85.9

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2600	2099	1661	1305	1072	945
Energy, Ft-Lb Per Grain		15.01	9.78	6.12	3.78	2.55	1.98
Time of Flight, Seconds		0.0000	0.1284	0.2892	0.4937	0.7494	1.0491
Bullet Path	Z 100 YDS	-1.5	0.0	-6.5	-26.0	-66.0	-136.1
(Inches) +/-	E R 200 YDS	-1.5	3.3	0.0	-16.1	-52.9	-119.7
Line of Sight	O 300 YDS	-1.5	8.7	10.8	0.0	-31.4	-92.8
Velocity, FPS		2500	2010	1586	1250	1042	926
Energy, Ft-Lb Per Grain		13.88	8.97	5.58	3.47	2.41	1.90
Time of Flight, Seconds		0.0000	0.1338	0.3021	0.5160	0.7811	1.0878
Bullet Path	Z 100 YDS	-1.5	0.0	-7.3	-28.7	-72.4	-148.0
(Inches) +/-	E R 200 YDS	-1.5	3.6	0.0	-17.7	-57.8	-129.8
Line of Sight	O 300 YDS	-1.5	9.6	11.8	0.0	-34.2	-100.3
Velocity, FPS		2400	1922	1512	1199	1015	909
Energy, Ft-Lb Per Grain		12.79	8.20	5.08	3.19	2.29	1.83
Time of Flight, Seconds		0.0000	0.1397	0.3159	0.5399	0.8141	1.1277
Bullet Path	Z 100 YDS	-1.5	0.0	-8.1	-31.7	-79.5	-161.0
(Inches) +/-	E R 200 YDS	-1.5	4.1	0.0	-19.5	-63.3	-140.7
Line of Sight	O 300 YDS	-1.5	10.6	13.0	0.0	-37.3	-108.2
Velocity, FPS		2300	1834	1441	1152	990	892
Energy, Ft-Lb Per Grain		11.74	7.47	4.61	2.95	2.18	1.77
Time of Flight, Seconds		0.0000	0.1461	0.3310	0.5654	0.8484	1.1687
Bullet Path	Z 100 YDS	-1.5	0.0	-9.0	-35.1	-87.3	-175.0
(Inches) +/-	E R 200 YDS	-1.5	4.5	0.0	-21.5	-69.2	-152.4
Line of Sight	O 300 YDS	-1.5	11.7	14.4	0.0	-40.5	-116.5
Velocity, FPS		2200	1747	1372	1110	967	875
Energy, Ft-Lb Per Grain		10.75	6.78	4.18	2.74	2.08	1.70
Time of Flight, Seconds		0.0000	0.1531	0.3473	0.5924	0.8838	1.2108
Bullet Path	Z 100 YDS	-1.5	0.0	-10.1	-39.0	-95.9	-190.1
(Inches) +/-	E R 200 YDS	-1.5	5.1	0.0	-23.8	-75.7	-164.7
Line of Sight	O 300 YDS	-1.5	13.0	15.9	0.0	-44.0	-125.1
Velocity, FPS		2100	1662	1306	1072	945	859
Energy, Ft-Lb Per Grain		9.79	6.13	3.79	2.55	1.98	1.64
Time of Flight, Seconds		0.0000	0.1607	0.3651	0.6207	0.9203	1.2540
Bullet Path	Z 100 YDS	-1.5	0.0	-11.3	-43.3	-105.3	-206.3
(Inches) +/-	E R 200 YDS	-1.5	5.7	0.0	-26.3	-82.6	-177.9
Line of Sight	O 300 YDS	-1.5	14.4	17.5	0.0	-47.6	-134.1
Velocity, FPS		2000	1577	1244	1039	924	843
Energy, Ft-Lb Per Grain		8.88	5.52	3.44	2.40	1.90	1.58
Time of Flight, Seconds		0.0000	0.1691	0.3842	0.6504	0.9579	1.2984
Bullet Path	Z 100 YDS	-1.5	0.0	-12.8	-48.1	-115.5	-223.6
(Inches) +/-	E R 200 YDS	-1.5	6.4	0.0	-29.0	-90.0	-191.8
Line of Sight	O 300 YDS	-1.5	16.0	19.3	0.0	-51.4	-143.5

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.17

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			1900	1494	1186	1008	904	828
Energy, Ft-Lb Per Grain			8.01	4.96	3.12	2.26	1.81	1.52
Time of Flight, Seconds			0.0000	0.1783	0.4049	0.6813	0.9966	1.3440
Bullet Path	Z	100 YDS	-1.5	0.0	-14.3	-53.4	-126.6	-242.2
(Inches) +/-	E	200 YDS	-1.5	7.2	0.0	-31.9	-97.9	-206.4
Line of Sight	R O	300 YDS	-1.5	17.8	21.3	0.0	-55.4	-153.2
Velocity. FPS			1800	1413	1135	980	885	812
Energy, Ft-Lb Per Grain			7.19	4.43	2.86	2.13	1.74	1.46
Time of Flight. Seconds			0.0000	0.1885	0.4270	0.7134	1.0363	1.3908
Bullet Path	Z	100 YDS	-1.5	0.0	-16.2	-59.3	-138.4	-262.1
(Inches) +/-	E	200 YDS	-1.5	8.1	0.0	-35.0	-106.1	-221.6
Line of Sight	R O	300 YDS	-1.5	19.8	23.3	0.0	-59.4	-163.3
Velocity, FPS			1700	1335	1088	954	866	797
Energy, Ft-Lb Per Grain			6.42	3.96	2.63	2.02	1.66	1.41
Time of Flight, Seconds			0.0000	0.1997	0.4506	0.7465	1.0772	1.4391
Bullet Path	Z	100 YDS	-1.5	0.0	-18.2	-65.7	-151.2	-283.2
(Inches) +/-	E	200 YDS	-1.5	9.1	0.0	-38.3	-114.8	-237.6
Line of Sight	R O	300 YDS	-1.5	21.9	25.6	0.0	-63.7	-173.8
Velocity, FPS			1600	1260	1047	930	848	781
Energy, Ft-Lb Per Grain			5.68	3.52	2.43	1.92	1.60	1.35
Time of Flight, Seconds			0.0000	0.2121	0.4754	0.7808	1.1194	1.4887
Bullet Path	Z	100 YDS	-1.5	0.0	-20.5	-72.6	-164.9	-305.6
(Inches) +/-	E	200 YDS	-1.5	10.3	0.0	-41.8	-123.8	-254.3
Line of Sight	R O	300 YDS	-1.5	24.2	27.9	0.0	-68.1	-184.6
Velocity, FPS			1500	1190	1010	906	829	765
Energy, Ft-Lb Per Grain			5.00	3.14	2.26	1.82	1.53	1.30
Time of Flight, Seconds			0.0000	0.2257	0.5015	0.8161	1.1630	1.5405
Bullet Path	Z	100 YDS	-1.5	0.0	-23.1	-80.1	-179.4	-329.6
(Inches) +/-	E	200 YDS	-1.5	11.5	0.0	-45.5	-133.3	-272.0
Line of Sight	R O	300 YDS	-1.5	26.7	30.3	0.0	-72.7	-196.2

Exterior Ballistic Table for Ballistic Coefficient 0.19

Velocity, FPS			4000	3385	2850	2374	1946	1572
Energy, Ft-Lb Per Grain			35.52	25.44	18.03	12.51	8.41	5.49
Time of Flight, Seconds			0.0000	0.0816	0.1783	0.2936	0.4333	0.6050
Bullet Path	Z	100 YDS	-1.5	0.0	-1.6	-7.5	-19.6	-41.1
(Inches) +/-	E	200 YDS	-1.5	0.8	0.0	-5.1	-16.5	-37.2
Line of Sight	R O	300 YDS	-1.5	2.5	3.4	0.0	-9.7	-28.7
Velocity, FPS			3900	3298	2774	2305	1885	1521
Energy, Ft-Lb Per Grain			33.77	24.15	17.08	11.80	7.89	5.14
Time of Flight, Seconds			0.0000	0.0837	0.1830	0.3016	0.4456	0.6230
Bullet Path	Z	100 YDS	-1.5	0.0	-1.7	-8.0	-21.0	-43.9
(Inches) +/-	E	200 YDS	-1.5	0.9	0.0	-5.4	-17.5	-39.5
Line of Sight	R O	300 YDS	-1.5	2.7	3.6	0.0	-10.3	-30.5

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3800	3212	2697	2237	1824	1470
Energy, Ft-Lb Per Grain		32.06	22.90	16.15	11.11	7.39	4.80
Time of Flight, Seconds		0.0000	0.0859	0.1879	0.3101	0.4587	0.6422
Bullet Path	Z 100 YDS	-1.5	0.0	-1.9	-8.6	-22.4	-46.9
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-5.8	-18.6	-42.1
Line of Sight	O 300 YDS	-1.5	2.9	3.9	0.0	-10.9	-32.5
Velocity, FPS		3700	3125	2620	2167	1763	1420
Energy, Ft-Lb Per Grain		30.39	21.68	15.24	10.43	6.90	4.48
Time of Flight, Seconds		0.0000	0.0883	0.1932	0.3191	0.4726	0.6626
Bullet Path	Z 100 YDS	-1.5	0.0	-2.1	-9.3	-24.1	-50.2
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-6.2	-19.9	-44.9
Line of Sight	O 300 YDS	-1.5	3.1	4.1	0.0	-11.6	-34.6
Velocity, FPS		3600	3038	2543	2097	1702	1370
Energy, Ft-Lb Per Grain		28.77	20.49	14.36	9.76	6.43	4.17
Time of Flight, Seconds		0.0000	0.0908	0.1988	0.3287	0.4876	0.6844
Bullet Path	Z 100 YDS	-1.5	0.0	-2.3	-10.1	-25.9	-53.8
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-6.6	-21.2	-48.1
Line of Sight	O 300 YDS	-1.5	3.4	4.4	0.0	-12.4	-37.1
Velocity, FPS		3500	2951	2465	2027	1641	1322
Energy, Ft-Lb Per Grain		27.20	19.33	13.49	9.12	5.98	3.88
Time of Flight, Seconds		0.0000	0.0934	0.2047	0.3389	0.5035	0.7077
Bullet Path	Z 100 YDS	-1.5	0.0	-2.5	-10.9	-27.8	-57.9
(Inches) +/-	E R 200 YDS	-1.5	1.3	0.0	-7.1	-22.7	-51.5
Line of Sight	O 300 YDS	-1.5	3.6	4.7	0.0	-13.3	-39.7
Velocity, FPS		3400	2863	2386	1957	1581	1276
Energy Ft-Lb Per Grain		25.66	18.20	12.64	8.50	5.55	3.61
Time of Flight, Seconds		0.0000	0.0962	0.2110	0.3499	0.5206	0.7325
Bullet Path	Z 100 YDS	-1.5	0.0	-2.8	-11.8	-30.0	-62.3
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-7.6	-24.4	-55.4
Line of Sight	O 300 YDS	-1.5	3.9	5.1	0.0	-14.3	-42.7
Velocity, FPS		3300	2775	2307	1886	1521	1232
Energy, Ft-Lb Per Grain		24.18	17.10	11.82	7.90	5.14	3.37
Time of Flight, Seconds		0.0000	0.0992	0.2178	0.3617	0.5390	0.7589
Bullet Path	Z 100 YDS	-1.5	0.0	-3.1	-12.8	-32.4	-67.3
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-8.2	-26.3	-59.6
Line of Sight	O 300 YDS	-1.5	4.3	5.4	0.0	-15.4	-46.0
Velocity, FPS		3200	2687	2227	1816	1463	1191
Energy Ft-Lb Per Grain		22.73	16.03	11.01	7.32	4.75	3.15
Time of Flight, Seconds		0.0000	0.1024	0.2250	0.3743	0.5586	0.7870
Bullet Path	Z 100 YDS	-1.5	0.0	-3.4	-13.9	-35.1	-72.8
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-8.8	-28.3	-64.3
Line of Sight	O 300 YDS	-1.5	4.6	5.9	0.0	-16.6	-49.7

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3100	2598	2147	1745	1405	1152
Energy, Ft-Lb Per Grain			21.33	14.98	10.23	6.76	4.38	2.95
Time of Flight, Seconds			0.0000	0.1058	0.2328	0.3879	0.5798	0.8169
Bullet Path	Z	100 YDS	-1.5	0.0	-3.7	-15.1	-38.1	-78.9
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-9.5	-30.6	-69.6
Line of Sight	O	300 YDS	-1.5	5.0	6.3	0.0	-17.9	-53.7
Velocity, FPS			3000	2509	2067	1675	1349	1117
Energy, Ft-Lb Per Grain			19.98	13.98	9.49	6.23	4.04	2.77
Time of Flight, Seconds			0.0000	0.1094	0.2412	0.4025	0.6025	0.8484
Bullet Path	Z	100 YDS	-1.5	0.0	-4.1	-16.5	-41.4	-85.7
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-10.3	-33.2	-75.4
Line of Sight	O	300 YDS	-1.5	5.5	6.9	0.0	-19.5	-58.2
Velocity, FPS			2900	2419	1986	1606	1295	1084
Energy, Ft-Lb Per Grain			18.67	12.99	8.76	5.73	3.72	2.61
Time of Flight, Seconds			0.0000	0.1133	0.2502	0.4183	0.6268	0.8817
Bullet Path	Z	100 YDS	-1.5	0.0	-4.5	-18.0	-45.2	-93.2
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-11.2	-36.1	-81.9
Line of Sight	O	300 YDS	-1.5	6.0	7.5	0.0	-21.2	-63.2
Velocity, FPS			2800	2329	1906	1538	1244	1055
Energy, Ft-Lb Per Grain			17.41	12.04	8.07	5.25	3.44	2.47
Time of Flight, Seconds			0.0000	0.1175	0.2599	0.4353	0.6529	0.9166
Bullet Path	Z	100 YDS	-1.5	0.0	-5.0	-19.7	-49.4	-101.6
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-12.2	-39.4	-89.1
Line of Sight	O	300 YDS	-1.5	6.6	8.2	0.0	-23.1	-68.7
Velocity, FPS			2700	2239	1826	1472	1197	1028
Energy, Ft-Lb Per Grain			16.18	11.13	7.40	4.81	3.18	2.35
Time of Flight, Seconds			0.0000	0.1220	0.2704	0.4537	0.68084	0.9530
Bullet Path	Z	100 YDS	-1.5	0.0	-5.5	-21.7	-54.1	-110.8
(Inches) + /-	E R	200 YDS	-1.5	2.8	0.0	-13.4	-43.0	-97.0
Line of Sight	O	300 YDS	-1.5	7.2	8.9	0.0	-25.2	-74.7
Velocity, FPS			2600	2149	1747	1407	1153	1003
Energy, Ft-Lb Per Grain			15.01	10.25	6.78	4.39	2.95	2.23
Time of Flight, Seconds			0.0000	0.1269	0.2818	0.4736	0.7104	0.9910
Bullet Path	Z	100 YDS	-1.5	0.0	-6.1	-23.9	-59.4	-121.0
(Inches) +/-	E R	200 YDS	-1.5	3.1	0.0	-14.7	-47.1	-105.6
Line of Sight	O	300 YDS	-1.5	8.0	9.8	0.0	-27.6	-81.2
Velocity, FPS			2500	2059	1669	1344	1113	981
Energy, Ft-Lb Per Grain			13.88	9.41	6.18	4.01	2.75	2.14
Time of Flight, Seconds			0.0000	0.1322	0.2942	0.4950	0.7418	1.0304
Bullet Path	Z	100 YDS	-1.5	0.0	-6.8	-26.3	-65.3	-132.2
(Inches) +/-	E R	200 YDS	-1.5	3.4	0.0	-16.1	-51.6	-115.1
Line of Sigt	O	300 YDS	-1.5	8.8	10.7	0.0	-30.2	-88.3

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2400	1969	1592	1284	1078	959
Energy, Ft-Lb Per Grain			12.79	8.61	5.63	3.66	2.58	2.04
Time of Flight, Seconds			0.0000	0.1380	0.3076	0.5180	0.7747	1.0711
Bullet Path	Z	100 YDS	-1.5	0.0	-7.6	-29.2	-71.9	-144.5
(Inches) +/-	E R	200 YDS	-1.5	3.8	0.0	-17.7	-56.7	-125.5
Line of Sight	O	300 YDS	-1.5	9.7	11.8	0.0	-33.0	-95.9
Velocity, FPS			2300	1880	1516	1229	1046	939
Energy, Ft-Lb Per Grain			11.74	7.85	5.10	3.35	2.43	1.96
Time of Flight, Seconds			0.0000	0.1443	0.3222	0.5428	0.8093	1.1131
Bullet Path	Z	100 YDS	-1.5	0.0	-8.5	-32.3	-79.3	-157.9
(Inches) +/-	E R	200 YDS	-1.5	4.2	0.0	-19.6	-62.3	-136.6
Line of Sight	O	300 YDS	-1.5	10.8	13.1	0.0	-36.2	-104.0
Velocity, FPS			2200	1792	1443	1177	1017	920
Energy, Ft-Lb Per Grain			10.75	7.13	4.62	3.08	2.30	1.88
Time of Flight, Seconds			0.0000	0.1512	0.3380	0.5693	0.8452	1.1564
Bullet Path	Z	100 YDS	-1.5	0.0	-9.5	-35.9	-87.4	-172.4
(Inches) +/-	E R	200 YDS	-1.5	4.8	0.0	-21.7	-68.4	-148.7
Line of Sight	O	300 YDS	-1.5	12.0	14.4	0.0	-39.5	-112.6
Velocity, FPS			2100	1704	1372	1131	991	901
Energy, Ft-Lb Per Grain			9.79	6.45	4.18	2.84	2.18	1.80
Time of Flight, Seconds			0.0000	0.1587	0.3553	0.5975	0.8825	1.2009
Bullet Path	Z	100 YDS	-1.5	0.0	-10.7	-40.0	-96.4	-188.3
(Inches) +/-	E R	200 YDS	-1.5	5.3	0.0	-24.0	-75.1	-161.6
Line of Sight	O	300 YDS	-1.5	13.3	16.0	0.0	-43.1	-121.6
Velocity, FPS			2000	1618	1304	1090	966	883
Energy, Ft-Lb Per Grain			8.88	5.81	3.78	2.64	2.07	1.73
Time of Flight, Seconds			0.0000	0.1669	0.3740	0.6273	0.9211	1.2466
Bullet Path	Z	100 YDS	-1.5	0.0	-12.0	-44.6	-106.3	-205.3
(Inches) +/-	E R	200 YDS	-1.5	6.0	0.0	-26.6	-82.4	-175.3
Line of Sight	O	300 YDS	-1.5	14.9	17.7	0.0	-46.9	-131.0
Velocity, FPS			1900	1533	1241	1053	943	866
Energy Ft-Lb Per Grain			8.01	5.22	3.42	2.46	1.97	1.66
Time of Flight, Seconds			0.0000	0.1760	0.3943	0.6586	0.9609	1.2935
Bullet Path	Z	100 YDS	-1.5	0.0	-13.5	-49.7	-117.2	-223.7
(Inches) +/-	E R	200 YDS	-1.5	6.8	0.0	-29.4	-90.1	-189.9
Line of Sight	O	300 YDS	-1.5	16.6	19.6	0.0	-50.9	-140.8
Velocity, FPS			1800	1450	1182	1020	921	849
Energy Ft-Lb Per Grain			7.19	4.67	3.10	2.31	1.88	1.60
Time of Flight, Seconds			0.0000	0.1860	0.4163	0.6913	1.0018	1.3417
Bullet Path	Z	100 YDS	-1.5	0.0	-15.3	-55.4	-128.9	-243.4
(Inches) +/-	E R	200 YDS	-1.5	7.6	0.0	-32.5	-98.4	-205.2
Line of Sight	O	300 YDS	-1.5	18.5	21.7	0.0	-55.0	-151.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.19

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			1700	1369	1129	989	900	832
Energy, Ft-Lb Per Grain			6.42	4.16	2.83	2.17	1.80	1.54
Time of Flight, Seconds			0.0000	0.1971	0.4399	0.7253	1.0440	1.3913
Bullet Path	ZERO	100 YDS	-1.5	0.0	-17.3	-61.7	-141.6	-264.5
(Inches) +/-		200 YDS	-1.5	8.6	0.0	-35.8	-107.1	-221.3
Line of Sight		300 YDS	-1.5	20.6	23.9	0.0	-59.3	-161.6
Velocity, FPS			1600	1291	1081	961	880	815
Energy Ft-Lb Per Grain			5.68	3.70	2.59	2.05	1.72	1.47
Time of Flight, Seconds			0.0000	0.2094	0.4650	0.7605	1.0875	1.4426
Bullet Path	ZERO	100 YDS	-1.5	0.0	-19.5	-68.6	-155.3	-287.1
(Inches) +/-		200 YDS	-1.5	9.8	0.0	-39.4	-116.3	-238.3
Line of Sight		300 YDS	-1.5	22.9	26.2	0.0	-63.8	-172.7
Velocity, FPS			1500	1217	1039	935	859	798
Energy, Ft-Lb Per Grain			5.00	3.29	2.40	1.94	1.64	1.41
Time of Flight, Seconds			0.0000	0.2230	0.4915	0.7970	1.1324	1.4954
Bullet Path	ZERO	100 YDS	-1.5	0.0	-22.0	-76.1	-170.0	-311.1
(Inches) +/-		200 YDS	-1.5	11.0	0.0	-43.1	-126.0	-256.0
Line of Sight		300 YDS	-1.5	25.4	28.7	0.0	-68.5	-184.2

Exterior Ballistic Table for Ballistic Coefficient 0.21

Velocity, FPS			3300	2822	2392	2001	1653	1359
Energy Ft-Lb Per Grain			24.18	17.68	12.70	8.89	6.07	4.10
Time Of Flight, Seconds			0.0000	0.0983	0.2138	0.3510	0.5160	0.7166
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.9	-12.0	-29.8	-60.5
(Inches) +/-		200 YDS	-1.5	1.5	0.0	-7.6	-24.0	-53.3
Line of Sight		300 YDS	-1.5	4.0	5.1	0.0	-13.9	-40.6
Velocity, FPS			3200	2733	2311	1928	1589	1308
Energy Ft-Lb Per Grain			22.73	16.58	11.86	8.25	5.61	3.80
Time of Flight, Seconds			0.0000	0.1015	0.2209	0.3630	0.5346	0.7431
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.2	-13.0	-32.3	-65.5
(Inches) +/-		200 YDS	-1.5	1.6	0.0	-8.2	-25.9	-57.5
Line of Sight		300 YDS	-1.5	4.3	5.5	0.0	-14.9	-43.8
Velocity, FPS			3100	2643	2229	1855	1526	1259
Energy, Ft-Lb Per Grain			21.33	15.51	11.03	7.64	5.17	3.52
Time of Flight, Seconds			0.0000	0.1048	0.2284	0.3760	0.5545	0.7715
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.5	-14.1	-35.0	-71.0
(Inches) +/-		200 YDS	-1.5	1.8	0.0	-8.6	-27.9	-62.1
Line of Sight		300 YDS	-1.5	4.7	5.9	0.0	-16.1	-47.4
Velocity, FPS			3000	2553	2147	1781	1465	1213
Energy, Ft-Lb Per Grain			19.98	14.47	10.23	7.04	4.76	3.27
Time of Flight, Seconds			0.0000	0.1084	0.2366	0.3900	0.5760	0.8018
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.9	-15.4	-38.0	-77.1
(Inches) +/-		200 YDS	-1.5	1.9	0.0	-9.6	-30.3	-67.3
Line of Sight		300 YDS	-1.5	5.1	6.4	0.0	-17.5	-51.4

SPEER

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2900	2463	2065	1709	1404	1171
Energy, Ft-Lb Per Grain			18.67	13.47	9.47	6.48	4.38	3.04
Time of Flight, Seconds			0.0000	0.1123	0.2453	0.4051	0.5991	0.8341
Bullet Path	Z	100 YDS	-1.5	0.0	-4.3	-16.9	-41.5	-83.9
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-10.4	-32.9	-73.2
Line of Sight	O	300 YDS	-1.5	5.6	6.9	0.0	-19.0	-55.8
Velocity, FPS			2800	2372	1983	1637	1346	1132
Energy, Ft-Lb Per Grain			17.41	12.49	8.73	5.95	4.02	2.84
Time of Flight, Seconds			0.0000	0.1164	0.2548	0.4214	0.6240	0.8683
Bullet Path	Z	100 YDS	-1.5	0.0	-4.8	-18.5	-45.3	-91.5
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-11.3	-35.8	-79.6
Line of Sight	O	300 YDS	-1.5	6.2	7.6	0.0	-20.7	-60.8
Velocity, FPS			2700	2281	1901	1566	1290	1096
Energy, Ft-Lb Per Grain			16.18	11.55	8.02	5.44	3.69	2.67
Time of Flight, Seconds			0.0000	0.1209	0.2650	0.4390	0.6507	0.9044
Bullet Path	Z	100 YDS	-1.5	0.0	-5.3	-20.3	-49.6	-100.0
(Inches) +/-	E R	200 YDS	-1.5	2.6	0.0	-12.4	-39.1	-86.9
Line of Sight	O	300 YDS	-1.5	6.8	8.3	0.0	-22.6	-66.2
Velocity, FPS			2600	2190	1819	1497	1237	1064
Energy, Ft-Lb Per Grain			15.01	10.65	7.35	4.98	3.40	2.51
Time of Flight, Seconds			0.0000	0.1257	0.2761	0.4581	0.6793	0.9423
Bullet Path	Z	100 YDS	-1.5	0.0	-5.6	-22.3	-54.5	-109.5
(Inches) +/-	E R	200 YDS	-1.5	2.9	0.0	-13.6	-42.8	-94.9
Line of Sight	O	300 YDS	-1.5	7.4	9.0	0.0	-24.7	-72.3
Velocity, FPS			2500	2099	1739	1429	1188	1035
Energy, Ft-Lb Per Grain			13.88	9.78	6.71	4.53	3.13	2.38
Time of Flight, Seconds			0.0000	0.1310	0.2881	0.4787	0.7099	0.9819
Bullet Path	Z	100 YDS	-1.5	0.0	-6.5	-24.6	-60.0	-120.0
(Inches) +/-	E R	200 YDS	-1.5	3.2	0.0	-14.9	-47.0	-103.8
Line of Sight	O	300 YDS	-1.5	8.2	9.9	0.0	-27.1	-78.9
Velocity, FPS			2400	2008	1659	1363	1143	1009
Energy, Ft-Lb Per Grain			12.79	8.95	6.11	4.12	2.90	2.26
Time of Flight, Seconds			0.0000	0.1367	0.3011	0.5010	0.7424	1.0232
Bullet Path	Z	100 YDS	-1.5	0.0	-7.2	-27 3	-66.2	-131.6
(Inches) +/-	E R	200 YDS	-1.5	3.6	0.0	-16.4	-51.7	-113.5
Line of Sight	O	300 YDS	-1.5	9.1	10.9	00	-29.8	-86.2
Velocity, FPS			2300	1918	1581	1301	1103	984
Energy, Ft-Lb Per Grain			11.74	8.17	5.55	3.76	2.70	2.15
Time of Flight, Seconds			0.0000	0.1429	0.3153	0.5250	0.7768	1.0659
Bullet Path	Z	100 YDS	-1.5	0.0	-8.1	-30.2	-73.1	-144.4
(Inches) +/-	E R	200 YDS	-1.5	4.0	0.0	-18.1	-56.9	-124.2
Line of Sight	O	300 YDS	-1.5	10.1	12.1	0.0	-32.7	-94.0

LONG RANGE TABLES **SPEER**

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2200	1828	1504	1243	1067	962
Energy, Ft-Lb Per Grain			10.75	7.42	5.02	3.43	2.53	2.05
Time of Flight, Seconds			0.0000	0.1496	0.3307	0.5509	0.8129	1.1100
Bullet Path	ZERO	100 YDS	-1.5	0.0	-9.0	-33.6	-80.8	-158.4
(Inches) +/-		200 YDS	-1.5	4.5	0.0	-20.1	-62.7	-135.8
Line of Sight		300 YDS	-1.5	11.2	13.4	0.0	-36.0	-102.4
Velocity, FPS			2100	1739	1430	1188	1035	940
Energy, Ft-Lb Per Grain			9.79	6.71	4.54	3.13	2 38	1.96
Time of Flight, Seconds			0.0000	0.1570	0.3475	0.5786	0.8506	1.1556
Bullet Path	ZERO	100 YDS	-1.5	0.0	-10.1	-37.5	-89.4	-173.7
(Inches) +/-		200 YDS	-1.5	5.1	0.0	-22.3	-69.1	-148.4
Line of Sight		300 YDS	-1.5	12.5	14.8	0.0	-39.5	-111.3
Velocity, FPS			2000	1652	1358	1139	1006	920
Energy, Ft-Lb Per Grain			8.88	6.06	4.09	2.88	2.25	1.88
Time of Flight, Seconds			0.0000	0.1652	0.3659	0.6083	0.8898	1.2024
Bullet Path	ZERO	100 YDS	-1.5	0.0	-11.4	-41.8	-99.0	-190.4
(Inches) +/-		200 YDS	-1.5	5.7	0.0	-24.7	-76.2	-161.9
Line of Sight		300 YDS	-1.5	13.9	16.5	0.0	-43.2	-120.7
Velocity, FPS			1900	1565	1289	1096	980	900
Energy, Ft-Lb Per Grain			8.01	5.44	3.69	2.67	2.13	1.80
Time of Flight, Seconds			0.0000	0.1741	0.3859	0.6397	0.9305	1.2507
Bullet Path	ZERO	100 YDS	-1.5	0.0	-12.9	-46.8	-109.6	-208.6
(Inches) +/-		200 YDS	-1.5	6.4	0.0	-27.5	-83.8	-176.4
Line of Sight		300 YDS	-1.5	15.6	18.3	0.0	-47.2	-130.6
Velocity, FPS			1800	1480	1225	1057	955	881
Energy, Ft-Lb Per Grain			7.19	4.86	3.33	2.48	2.02	1.72
Time of Flight, Seconds			0.0000	0.1840	0.4076	0.6728	0.9725	1.3002
Bullet Path	ZERO	100 YDS	-1.5	0.0	-14.6	-52.3	-121.1	-228.1
(Inches) +/-		200 YDS	-1.5	7.3	0.0	-30.5	-92.0	-191.7
Line of Sight		300 YDS	-1.5	17.4	20.3	0.0	-51.4	-140.9
Velocity, FPS			1700	1397	1166	1022	931	863
Energy, Ft-Lb Per Grain			6.42	4.33	3.02	2.32	1.92	1.65
Time of Flight, Seconds			0.0000	0.1950	0.4311	0.7074	1.0158	1.3512
Bullet Path	ZERO	100 YDS	-1.5	0.0	-16.5	-58.5	-133.8	-249.2
(Inches) +/-		200 YDS	-1.5	8.2	0.0	-33.8	-100.8	-208.0
Line of Sight		300 YDS	-1.5	19.5	22.5	0.0	-55.7	-151.6
Velocity, FPS			1600	1316	1113	990	908	844
Energy, Ft-Lb Per Grain			5.68	3.84	2.75	2.18	1.83	1.58
Time of Flight, Seconds			0.0000	0.2072	0.4564	0.7435	1.0606	1.4038
Bullet Path	ZERO	100 YDS	-1.5	0.0	-18.7	-65.4	-147.5	-271.8
(Inches) +/-		200 YDS	-1.5	9.3	0.0	-37 4	-110.1	-225.1
Line of Sight		300 YDS	-1.5	21.8	24.9	0.0	-60.3	-162.8

Exterior Ballistic Table for Ballistic Coefficient 0.21

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		1500	1239	1066	960	886	826
Energy, Ft-Lb Per Grain		5.00	3.41	2.52	2.05	1.74	1.51
Time of Flight, Seconds		0.0000	0.2207	0.4832	0.7808	1.1068	1.4583
Bullet Path	Z 100 YDS	-1.5	0.0	-21.2	-72.9	-162.3	-296.1
(Inches) +/-	E R 200 YDS	-1.5	10.6	0.0	-41.1	-119.9	-243.1
Line of Sight	O 300 YDS	-1.5	24.3	27.4	0.0	-65.1	-174.6

Exterior Ballistic Table for Ballistic Coefficient 0.22

Velocity, FPS		3600	3110	2672	2274	1911	1589
Energy, Ft-Lb Per Grain		28.77	21.47	15.85	11.48	8.11	5.61
Time of Flight, Seconds		0.0000	0.0897	0.1938	0.3155	0.4595	0.6318
Bullet Path	Z 100 YDS	-1.5	0.0	-2.1	-9.2	-23.0	-46.5
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-6.0	-18.7	-41.2
Line of Sight	O 300 YDS	-1.5	3.1	4.0	0.0	-10.8	-31.2

Velocity, FPS		3500	3022	2592	2200	1845	1532
Energy, Ft-Lb Per Grain		27.20	20.27	14.92	10.75	7.56	5.21
Time of Flight, Seconds		0.0000	0.0923	0.1995	0.3252	0.4741	0.6527
Bullet Path	Z 100 YDS	-1.5	0.0	-2.3	-9.9	-24.7	-49.9
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-6.4	-20.0	-44.0
Line of Sight	O 300 YDS	-1.5	3.3	4.3	0.0	-11.5	-33.4

Velocity, FPS		3400	2932	2511	2127	1779	1475
Energy, Ft-Lb Per Grain		25.66	19.09	14.00	10.04	7.03	4.83
Time of Flight, Seconds		0.0000	0.0951	0.2056	0.3355	0.4898	0.6752
Bullet Path	Z 100 YDS	-1.5	0.0	-2.6	-10.7	-26.6	-53.7
(Inches) +/-	E R 200 YDS	-1.5	1.3	0.0	-6.9	-21.5	-47.3
Line of Sight	O 300 YDS	-1.5	3.6	4.6	0.0	-12.3	-35.8

Velocity, FPS		3300	2843	2430	2052	1713	1420
Energy, Ft-Lb Per Grain		24.18	17.94	13.11	9.35	6.51	4.48
Time of Flight, Seconds		0.0000	0.0980	0.2122	0.3465	0.5066	0.6993
Bullet Path	Z 100 YDS	-1.5	0.0	-2.8	-11.6	-28.8	-57.9
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-7.4	-23.1	-50.8
Line of Sight	O 300 YDS	-1.5	3.9	4.9	0.0	-13.3	-38.5

Velocity, FPS		3200	2753	2348	1978	1647	1366
Energy, Ft-Lb Per Grain		22.73	16.83	12.24	8.69	6.02	4.14
Time of Flight, Seconds		0.0000	0.1011	0.2191	0.3584	0.5247	0.7251
Bullet Path	Z 100 YDS	-1.5	0.0	-3.1	-12.6	-31.1	-62.6
(Inches) +/-	E R 200 YDS	-1.5	1.6	0.0	-7.9	-24.9	-54.8
Line of Sight	O 300 YDS	-1.5	4.2	5.3	0.0	-14.3	-41.5

Velocity, FPS		3100	2663	2265	1903	1582	1313
Energy, Ft-Lb Per Grain		21.33	15.74	11.39	8.04	5.56	3.33
Time of Flight, Seconds		0.0000	0.1044	0.2266	0.3711	0.5441	0.7527
Bullet Path	Z 100 YDS	-1.5	0.0	-3.4	-13.7	-33.8	-67.8
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-8.6	-26.9	-59.2
Line of Sight	O 300 YDS	-1.5	4.6	5.7	0.0	-15.4	-44.9

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3000	2572	2183	1829	1518	1263
Energy Ft-Lb Per Grain			19.98	14.69	10.58	7.43	5.12	3.54
Time of Flight, Seconds			0.0000	0.1080	0.2346	0.3848	0.5651	0.7823
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.8	-15.0	-36.7	-73.7
(Inches) +/-		200 YDS	-1.5	1.9	0.0	-9.3	-29.1	-64.2
Line of Sight		300 YDS	-1.5	5.0	6.2	0.0	-16.7	-48.7
Velocity, FPS			2900	2482	2100	1755	1455	1216
Energy, Ft-Lb Per Grain			18.67	13.68	9.79	6.84	4.70	3.28
Time of Flight, Seconds			0.0000	0.1119	0.2433	0.3997	0.5876	0.8139
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.2	-16.4	-40.0	-80.2
(Inches) +/-		200 YDS	-1.5	2.1	0.0	-10.1	-31.6	-69.7
Line of Sight		300 YDS	-1.5	5.5	6.7	0.0	-18.2	-52.9
Velocity, FPS			2800	2390	2017	1681	1394	1172
Energy, Ft-Lb Per Grain			17.41	12.68	9.03	6.27	4.31	3.05
Time of Flight, Seconds			0.0000	0.1160	0.2526	0.4156	0.6119	0.8476
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.6	-17.9	-43.7	-87.5
(Inches) +/-		200 YDS	-1.5	2.3	0.0	-11.0	-34.4	-75.9
Line of Sight		300 YDS	-1.5	6.0	7.3	0.0	-19.8	-51.6
Velocity, FPS			2700	2299	1934	1609	1335	1132
Energy, Ft-Lb Per Grain			16.18	11.73	8.30	5.75	3.96	2.84
Time of Flight, Seconds			0.0000	0.1204	0.2627	0.4329	0.6381	0.8833
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.1	-19.7	-47.9	-95.7
(Inches) +/-		200 YDS	-1.5	2.6	0.0	-12.0	-37.6	-82.8
Line of Sight		300 YDS	-1.5	6.6	8.0	0.0	-21.6	-62.8
Velocity, FPS			2600	2208	1851	1537	1278	1096
Energy, Ft-Lb Per Grain			15.01	10.82	7.61	5.24	3.63	2.67
Time of Flight, Seconds			0.0000	0.1252	0.2737	0.4516	0.6662	0.9210
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.7	-21.7	-52.6	-104.8
(Inches) +/-		200 YDS	-1.5	2.9	0.0	-13.1	-41.1	-90.5
Line of Sight		300 YDS	-1.5	7.2	8.7	0.0	-23.6	-68.6
Velocity, FPS			2500	2116	1770	1468	1225	1063
Energy, Ft-Lb Per Grain			13.88	9.94	6.96	4.78	3.33	2.51
Time of Flight, Seconds			0.0000	0.1304	0.2855	0.4719	0.6963	0.9606
Bullet Path	ZERO	100 YDS	-1.5	0.0	-6.4	-23.9	-57.8	-114.9
(Inches) +/-		200 YDS	-1.5	3.2	0.0	-14.4	-45.1	-99.1
Line of Sight		300 YDS	-1.5	8.0	9.6	0.0	-25.9	-75.0
Velocity, FPS			2400	2025	1689	1400	1177	1034
Energy, Ft-Lb Per Grain			12.79	9.10	6.33	4.35	3.08	2.37
Time of Flight, Seconds			0.0000	0.1361	0.2984	0.4938	0.7285	1.0019
Bullet Path	ZERO	100 YDS	-1.5	0.0	-7.1	-26.5	-63.8	-126.2
(Inches) +/-		200 YDS	-1.5	3.5	0.0	-15.9	-49.6	-108.5
Line of Sight		300 YDS	-1.5	8.8	10.6	0.0	-28.5	-82.1

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2300	1935	1609	1335	1132	1007
Energy, Ft-Lb Per Grain			11.74	8.31	5.75	3.96	2.84	2.25
Time of Flight, Seconds			0.0000	0.1422	0.3124	0.5175	0.7626	1.0448
Bullet Path	Z	100 YDS	-1.5	0.0	-7.9	-29.4	-70.5	-138.7
(Inches) +/-	E R	200 YDS	-1.5	4.0	0.0	-17.5	-54.7	-118.9
Line of Sight	O	300 YDS	-1.5	9.8	11.7	0.0	-31.3	-89.7
Velocity, FPS			2200	1844	1531	1274	1093	982
Energy, Ft-Lb Per Grain			10.75	7.55	5.20	3.60	2.65	2.14
Time of Flight, Seconds			0.0000	0.1490	0.3277	0.5430	0.7986	1.0894
Bullet Path	Z	100 YDS	-1.5	0.0	-8.8	-32.7	-78.0	-152.4
(Inches) +/-	E R	200 YDS	-1.5	4.4	0.0	-19.4	-60.4	-130.3
Line of Sight	O	300 YDS	-1.5	10.9	12.9	0.0	-34.5	-98.0
Velocity, FPS			2100	1755	1455	1216	1057	959
Energy, Ft-Lb Per Grain			9.79	6.84	4.70	3.28	2.48	2.04
Time of Flight, Seconds			0.0000	0.1563	0.3443	0.5705	0.8365	1.1354
Bullet Path	Z	100 YDS	-1.5	0.0	-9.9	-36.4	-86.5	-167.5
(Inches) +/-	E R	200 YDS	-1.5	5.0	0.0	-21.5	-66.6	-142.7
Line of Sight	O	300 YDS	-1.5	12.1	14.4	0.0	-37.9	-106.8
Velocity, FPS			2000	1666	1382	1164	1026	937
Energy, Ft-Lb Per Grain			8.88	6.16	4.24	3.01	2.34	1.95
Time of Flight, Seconds			0.0000	0.1644	0.3624	0.6000	0.8759	1.1828
Bullet Path	Z	100 YDS	-1.5	0.0	-11.2	-40.7	-95.9	-184.0
(Inches) +/-	E R	200 YDS	-1.5	5.6	0.0	-23.9	-73.5	-156.1
Line of Sight	O	300 YDS	-1.5	13.6	16.0	0.0	-41.6	-116.2
Velocity, FPS			1900	1579	1311	1117	997	917
Energy, Ft-Lb Per Grain			8.01	5.54	3.82	2.77	2.21	1.87
Time of Flight, Seconds			0.0000	0.1733	0.3823	0.6314	0.9170	1.2315
Bullet Path	Z	100 YDS	-1.5	0.0	-12.6	-45.5	-106.3	-202.0
(Inches) +/-	E R	200 YDS	-1.5	6.3	0.0	-26.6	-81.1	-170.5
Line of Sight	O	300 YDS	-1.5	15.2	17.8	0.0	-45.6	-126.1
Velocity, FPS			1800	1493	1245	1075	970	897
Energy, Ft-Lb Per Grain			7.19	4.95	3.44	2.57	2.09	1.79
Time of Flight, Seconds			0.0000	0.1832	0.4039	0.6646	0.9594	1.2817
Bullet Path	Z	100 YDS	-1.5	0.0	-14.3	-51.0	-117.8	-221.5
(Inches) +/-	E R	200 YDS	-1.5	7.1	0.0	-29.6	-89.3	-185.8
Line of Sight	O	300 YDS	-1.5	17.0	19.8	0.0	-49.8	-136.5
Velocity, FPS			1700	1409	1183	1037	945	877
Energy, Ft-Lb Per Grain			6.42	4.41	3.11	2.39	1.98	1.71
Time of Flight, Seconds			0.0000	0.1941	0.4273	0.6994	1.0032	1.3334
Bullet Path	Z	100 YDS	-1.5	0.0	-16.2	-57.2	-130.4	-242.5
(Inches) +/-	E R	200 YDS	-1.5	8.1	0.0	-32.9	-98.1	-202.1
Line of Sight	O	300 YDS	-1.5	19.1	21.9	0.0	-54.2	-147.3

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.22

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			1600	1328	1127	1004	921	858
Energy, Ft-Lb Per Grain			5.68	3.92	2.82	2.24	1.88	1.63
Time of Flight, Seconds			0.0000	0.2062	0.4526	0.7359	1.0486	1.3867
Bullet Path	Z	100 YDS	-1.5	0.0	-18.3	-64.0	-144.1	-265.2
(Inches) +/-	E R	200 YDS	-1.5	9.2	0.0	-36.5	-107.4	-219.3
Line of Sight	O	300 YDS	-1.5	21.3	24.3	0.0	-58.8	-158.5
Velocity, FPS			1500	1250	1078	972	898	839
Energy Ft-Lb Per Grain			5.00	3.47	2.58	2.10	1.79	1.56
Time of Flight, Seconds			0.0000	0.2197	0.4796	0.7737	1.0954	1.4418
Bullet Path	Z	100 YDS	-1.5	0.0	-20.8	-71.5	-158.9	-289 5
(Inches) +/-	E R	200 YDS	-1.5	10.4	0.0	-40.3	-117.3	-237.5
Line of Sight	O	300 YDS	-1.5	23.8	26.8	0.0	-63.6	-170.4

Exterior Ballistic Table for Ballistic Coefficient 0.23

Velocity, FPS			4000	3485	3028	2616	2238	1894
Energy, Ft-Lb Per Grain			35.52	26.96	20.36	15.19	11.12	7.96
Time of Flight, Seconds			0.0000	0.0804	0.1728	0.2794	0.4034	0.5492
Bullet Path	Z	100 YDS	-1.5	0.0	-1.4	-6.6	-16.9	-34.2
(Inches) +/-	E R	200 YDS	-1.5	0.7	0.0	-4.5	-14.1	-30.8
Line of Sight	O	300 YDS	-1.5	2.2	3.0	0.0	-8.1	-23.3
Velocity, FPS			3900	3397	2949	2544	2172	1834
Energy, Ft-Lb Per Grain			33.77	25.62	19.31	14.37	10.47	7.47
Time of Flight, Seconds			0.0000	0.0825	0.1773	0.2869	0.4145	0.5649
Bullet Path	Z	100 YDS	-1.5	0.0	-1.5	-7.1	-18.1	-36.5
(Inches) +/-	E R	200 YDS	-1.5	0.8	0.0	-4.8	-15.0	-32.7
Line of Sight	O	300 YDS	-1.5	2.4	3.2	0.0	-8.6	-24.7
Velocity, FPS			3800	3308	2869	2471	2106	1774
Energy, Ft-Lb Per Grain			32.06	24.29	18.27	13.56	9.85	6.99
Time of Flight, Seconds			0.0000	0.0847	0.1821	0.2948	0.4263	0.5816
Bullet Path	Z	100 YDS	-1.5	0.0	-1.7	-7.7	-19.4	-39.0
(Inches) +/-	E R	200 YDS	-1.5	0.8	0.0	-5.1	-16.0	-34.7
Line of Sight	O	300 YDS	-1.5	2.6	3.4	0.0	-9.2	-26.2
Velocity, FPS			3700	3220	2789	2398	2039	1714
Energy, Ft-Lb Per Grain			30.39	23.02	17.27	12.77	9.23	6.52
Time of Flight, Seconds			0.0000	0.0870	0.1871	0.3031	0.4388	0.5994
Bullet Path	Z	100 YDS	-1.5	0.0	-1.9	-8.3	-20.7	-41.7
(Inches) +/-	E R	200 YDS	-1.5	0.9	0.0	-5.4	-17.0	-37.0
Line of Sight	O	300 YDS	-1.5	2.8	3.6	0.0	-9.7	-27.9
Velocity, FPS			3600	3131	2709	2324	1971	1655
Energy, Ft-Lb Per Grain			28.77	21.76	16.29	11.99	8.62	6.08
Time of Flight, Seconds			0.0000	0.0894	0.1925	0.3121	0.4522	0.6184
Bullet Path	Z	100 YDS	-1.5	0.0	-2.1	-8.9	-22.3	-44.7
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.8	-18.1	-39.5
Line of Sight	O	300 YDS	-1.5	3.0	3.9	0.0	-10.4	-29.8

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3500	3041	2628	2250	1904	1596
Energy, Ft-Lb Per Grain			27.20	20.53	15.33	11.24	8.05	5.65
Time of Flight, Seconds			0.0000	0.0920	0.1981	0.3216	0.4665	0.6388
Bullet Path	Z	100 YDS	-1.5	0.0	-2.3	-9.7	-24.0	-48.0
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-6.2	-19.4	-42.2
Line of Sight	O	300 YDS	-1.5	3.2	4.1	0.0	-11.1	-31.9
Velocity, FPS			3400	2952	2546	2175	1836	1537
Energy, Ft-Lb Per Grain			25.66	19.35	14.39	10.50	7.48	5.24
Time of Flight, Seconds			0.0000	0.0947	0.2042	0.3317	0.4819	0.6606
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-10.5	-25.8	-51.6
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.7	-20.8	-45.3
Line of Sight	O	300 YDS	-1.5	3.5	4.4	0.0	-11.9	-34.2
Velocity, FPS			3300	2862	2464	2100	1769	1479
Energy, Ft-Lb Per Grain			24.18	18.18	13.48	9.79	6.95	4.86
Time of Flight, Seconds			0.0000	0.0977	0.2107	0.3426	0.4983	0.6840
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-11.3	-27.9	-55.6
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-7.2	-22.3	-48.7
Line of Sight	O	300 YDS	-1.5	3.8	4.8	0.0	-12.7	-36.7
Velocity, FPS			3200	2772	2382	2024	1701	1422
Energy, Ft-Lb Per Grain			22.73	17.06	12.60	9.09	6.42	4.49
Time of Flight, Seconds			0.0000	0.1008	0.2176	0.3542	0.5160	0.7091
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-12.3	-30.1	-60.1
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-7.7	-24.0	-52.5
Line of Sight	O	300 YDS	-1.5	4.1	5.1	0.0	-13.7	-39.6
Velocity, FPS			3100	2681	2299	1948	1634	1366
Energy, Ft-Lb Per Grain			21.33	15.96	11.73	8.42	5.93	4.14
Time of Flight, Seconds			0.0000	0.1041	0.2250	0.3667	0.5350	0.7360
Bullet Path	Z	100 YDS	-1.5	0.0	-3.4	-13.4	-32.7	-65.1
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-8.3	-25.9	-56.7
Line of Sight	O	300 YDS	-1.5	4.5	5.6	0.0	-14.8	-42.8
Velocity, FPS			3000	2590	2215	1873	1568	1313
Energy, Ft-Lb Per Grain			19.98	14.89	10.89	7.79	5.46	3.83
Time of Flight, Seconds			0.0000	0.1076	0.2329	0.3802	0.5554	0.7649
Bullet Path	Z	100 YDS	-1.5	0.0	-3.7	-14.6	-35.5	-70.7
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-9.0	-28.1	-61.4
Line of Sight	O	300 YDS	-1.5	4.9	6.0	0.0	-16.0	-46.4
Velocity, FPS			2900	2499	2131	1797	1503	1262
Energy, Ft-Lb Per Grain			18.67	13.86	10.08	7.17	5.02	3.54
Time of Flight, Seconds			0.0000	0.1115	0.2415	0.3948	0.5775	0.7959
Bullet Path	Z	100 YDS	-1.5	0.0	-4.1	-16.0	-38.7	-77.0
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-9.8	-30.5	-66.7
Line of Sight	O	300 YDS	-1.5	5.3	6.5	0.0	-17.4	-50.4

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2800	2408	2048	1722	1440	1213
Energy, Ft-Lb Per Grain			17.41	12.87	9.31	6.58	4.60	3.27
Time of Flight, Seconds			0.0000	0.1156	0.2507	0.4105	0.6012	0.8289
Bullet Path	Z	100 YDS	-1.5	0.0	-4.6	-17.5	-42.3	-84.0
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-10.7	-33.2	-72.6
Line of Sight	O	300 YDS	-1.5	5.8	7.1	0.0	-19.0	-54.8
Velocity, FPS			2700	2316	1964	1648	1378	1169
Energy, Ft-Lb Per Grain			16.18	11.91	8.56	6.03	4.22	3.03
Time of Flight, Seconds			0.0000	0.1200	0.2607	0.4275	0.6269	0.8642
Bullet Path	Z	100 YDS	-1.5	0.0	-5.0	-19.2	-46.3	-91.8
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-11.6	-36.2	-79.2
Line of Sight	O	300 YDS	-1.5	6.4	7.8	0.0	-20.7	-59.8
Velocity, FPS			2600	2224	1881	1576	1318	1128
Energy, Ft-Lb Per Grain			15.01	10.98	7.85	5.51	3.86	2.82
Time of Flight, Seconds			0.0000	0.1248	0.2715	0.4459	0.6544	0.9015
Bullet Path	Z	100 YDS	-1.5	0.0	-5.6	-21.1	-50.8	-100.6
(Inches) +/-	E R	200 YDS	-1.5	2.8	0.0	-12.7	-39.6	-86.6
Line of Sight	O	300 YDS	-1.5	7.0	8.5	0.0	-22.6	-65.4
Velocity, FPS			2500	2132	1798	1504	1262	1092
Energy Ft-Lb Per Grain			13.88	10.09	7.18	5.02	3.54	2.65
Time of Flight, Seconds			0.0000	0.1299	0.2832	0.4658	0.6841	0.9409
Bullet Path	Z	100 YDS	-1.5	0.0	-6.2	-23.3	-55.9	-110.5
(Inches) +/-	E R	200 YDS	-1.5	3.1	0.0	-14.0	-43.5	-94.9
Line of Sight	O	300 YDS	-1.5	7.8	9.3	0.0	-24.8	-71.6
Velocity, FPS			2400	2041	1716	1435	1210	1059
Energy, Ft-Lb Per Grain			12.79	9.25	6.54	4.57	3.25	2.49
Time of Flight, Seconds			0.0000	0.1356	0.2959	0.4874	0.7158	0.9822
Bullet Path	Z	100 YDS	-1.5	0.0	4.9	-25.8	-61.7	-121.4
(Inches) +/-	E R	200 YDS	-1.5	3.5	0.0	-15.4	47.8	-104.1
Line of Sight	O	300 YDS	-1.5	8.6	10.3	0.0	-27.3	-78.4
Velocity, FPS			2300	1950	1636	1367	1161	1029
Energy, Ft-Lb Per Grain			11.74	8.44	5.94	4.15	2.99	2.35
Tinne of Flight, Seconds			0.0000	0.1417	0.3098	0.5107	0.7497	1.0253
Bullet Path	Z	100 YDS	-1.5	0.0	-7.7	-28.6	-68.2	-133.6
(Inches) +/-	E R	200 YDS	-1.5	3.9	0.0	-17.0	-52.7	-114.2
Line of Sight	O	300 YDS	-1.5	9.5	11.3	0.0	-30.1	-85.9
Velocity, FPS			2200	1859	1557	1303	1118	1002
Energy, Ft-Lb Per Grain			10.75	7.67	5.38	3.77	2.77	2.23
Time of Flight, Seconds			0.0000	0.1484	0.3249	0.5359	0.7856	1.0701
Bullet Path	Z	100 YDS	-1.5	0.0	-8.7	-31.8	-75.6	-147.1
(Inches) +/-	E R	200 YDS	-1.5	4.3	0.0	-18.8	-48.2	-125.4
Line of Sight	O	300 YDS	-1.5	10.6	12.6	0.0	-33.1	-94.0

Exterior Ballistic Table for Ballistic Coefficient 0.23

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2100	1769	1479	1243	1080	977
Energy, Ft-Lb Per Grain			9.79	6.95	4.86	3.43	2.59	2.12
Time of Flight, Seconds			0.0000	0.1557	0.3414	0.5632	0.8234	1.1165
Bullet Path	Z	100 YDS	-1.5	0.0	-9.7	-35.5	-83.8	-161.9
(Inches) +/-	E R	200 YDS	-1.5	4.9	0.0	-20 9	-64.4	-137.6
Line of Sight	O	300 YDS	-1.5	11.8	13.9	0.0	-36.5	-102.7
Velocity, FPS			2000	1680	1404	1187	1045	954
Energy, Ft-Lb Per Grain			8.88	6.27	4.38	3.13	2.42	2.02
Time of Flight, Seconds			0.0000	0.1637	0.3593	0.5925	0.8631	1.1644
Bullet Path	Z	100 YDS	-1.5	0.0	-11.0	-39.7	-93.1	-178.2
(Inches) +/-	E R	200 YDS	-1.5	5.5	0.0	-23.3	-71.2	-150.8
Line of Sight	O	300 YDS	-1.5	13.2	15.5	0.0	-40.2	-112.1
Velocity, FPS			1900	1592	1332	1137	1014	932
Energy, Ft-Lb Per Grain			8.01	5.63	3.94	2.87	2.28	1.93
Time of Flight, Seconds			0.0000	0.1726	0.3790	0.6238	0.9044	1.2137
Bulet Path	Z	100 YDS	-1.5	0.0	-12.4	-44.4	-103.4	-196.0
(Inches) +/-	E R	200 YDS	-1.5	6.2	0.0	-25.9	-78.6	-165.1
Line of Sight	O	300 YDS	-1.5	14.8	17.3	0.0	-44.1	-122.0
Velocity. FPS			1800	1506	1263	1092	986	911
Energy, Ft-Lb Per Grain			7.19	5.04	3.54	2.65	2.16	1.84
Time of Flight, Sights			0.0000	0.1824	0.4005	0.6570	0.9472	1.2645
Bullet Path	Z	100 YDS	-1.5	0.0	-14.0	-49.8	-114.7	-215.4
(Inches) +/-	E R	200 YDS	-1.5	7.0	0.0	-28.8	-86.8	-180.5
Line of Sight	O	300 YDS	-1.5	16.6	19.2	0.0	-48.3	-132.4
Velocity, FPS			1700	1421	1200	1053	959	891
Energy Ft-Lb Per Grain			6.42	4.48	3.20	2.46	2.04	1.76
Time of Flight, Seconds			0.0000	0.1933	0.4238	0.6921	0.9916	1.3168
Bullet Path	Z	100 YDS	-1.5	0.0	-15.9	-55.9	-127.3	-236.4
(Inches) +/-	E R	200 YDS	-1.5	7.9	0.0	-32.1	-95.5	-196.7
Line of Sight	O	300 YDS	-1.5	18.6	21.4	0.0	-52.7	-143.2
Velocity, FPS			1600	1338	1141	1017	934	871
Energy, Ft-Lb Per Grain			5.68	3.97	2.89	2.30	1.94	1.68
Time of Flight, Seconds			0.0000	0.2054	0.4491	0.7288	1.0374	1.3707
Bullet Path	Z	100 YDS	-1.5	0.0	-18.0	-62.7	-141.0	-259.1
(Inches) +/-	E R	200 YDS	-1.5	9.0	0.0	-35.7	-104.9	-214.0
Line of Sight	O	300 YDS	-1.5	20.9	23.8	0.0	-57.3	-154.6
Velocity, FPS			1500	1259	1090	984	910	851
Energy, Ft-Lb Per Grain			5.00	3.52	2.64	2.15	1.84	1.61
Time of Flight, Seconds			0.0000	0.2189	0.4762	0.7670	1.0848	1.4265
Bullet Path	Z	100 YDS	-1.5	0.0	-20.5	-70.2	-155.8	-283.5
(Inches) +/-	E R	200 YDS	-1.5	10.3	0.0	-39.5	-114.8	-232.2
Line of Sight	O	300 YDS	-1.5	23.4	26.3	0.0	-62.2	-166.5

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.24

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2800	2423	2077	1761	1483	1255
Energy, Ft-Lb Per Grain		17.41	13.03	9.58	6.88	4.88	3.50
Time of Flight, Seconds		0.0000	0.1152	0.2489	0.4059	0.5917	0.8121
Bullet Path	Z 100 YDS	-1.5	0.0	-4.5	-17.1	-41.0	-80.9
(Inches) +/-	E R 200 YDS	-1.5	2.2	0.0	-10.4	-32.1	-69.7
Line of Sight	O 300 YDS	-1.5	5.7	6.9	0.0	-18.2	-52.4
Velocity, FPS		2700	2331	1992	1686	1419	1206
Energy, Ft-Lb Per Grain		16.18	12.06	8.81	6.31	4.47	3.23
Time of Flight, Seconds		0.0000	0.1196	0.2588	0.4226	0.6168	0.8468
Bullet Path	Z 100 YDS	-1.5	0.0	-5.0	-18.8	-44.9	-88.5
(Inches) +/-	E R 200 YDS	-1.5	2.5	0.0	-11.3	-32.0	-76.1
Line of Sight	O 300 YDS	-1.5	6.3	7.6	0.0	-19.9	-57.2
Velocity, FPS		2600	2239	1908	1611	1357	1161
Energy, Ft-Lb Per Grain		15.01	11.13	8.08	5.76	4.09	2.99
Time of Flight, Seconds		0.0000	0.1243	0.2695	0.4407	0.6439	0.8837
Bullet Path	Z 100 YDS	-1.5	0.0	-5.5	-20.6	-49.3	-97.0
(Inches) +/-	E R 200 YDS	-1.5	2.7	0.0	-12.4	-38.3	-83.2
Line of Sight	O 300 YDS	-1.5	6.9	8.3	0.0	-21.8	-62.6
Velocity, FPS		2500	2147	1825	1538	1298	1121
Energy, Ft-Lb Per Grain		13.88	10.23	7.39	5.25	3.74	2.79
Time of Flight, Seconds		0.0000	0.1295	0.2811	0.4603	0.6731	0.9228
Bullet Path	Z 100 YDS	-1.5	0.0	-6.1	-22.8	-54.3	-106.5
(Inches) +/-	E R 200 YDS	-1.5	3.1	0.0	-13.6	-42.0	-91.2
Line of Sight	O 300 YDS	-1.5	7.6	9.1	0.0	-23.9	-68.5
Velocity, FPS		2400	2055	1742	1467	1242	1084
Energy, Ft-Lb Per Grain		12.79	9.38	6.74	4.78	3.42	2.61
Time of Flight, Seconds		0.0000	0.1351	0.2937	0.4816	0.7044	0.9640
Bullet Path	Z 100 YDS	-1.5	0.0	-6.8	-25.2	-59.9	-117.1
(Inches) +/-	E R 200 YDS	-1.5	3.4	0.0	-15.0	-46.3	-100.1
Line of Sight	O 300 YDS	-1.5	8.4	10.0	0.0	-26.3	-75.1
Velocity, FPS		2300	1964	1660	1398	1191	1052
Energy, Ft-Lb Per Grain		11.74	8.56	6.12	4.34	3.15	2.46
Time of Flight, Seconds		0.0000	0.1412	0.3074	0.5046	0.7379	1.0072
Bullet Path	Z 100 YDS	-1.5	0.0	-7.6	-28.0	-66.2	-129.0
(Inches) +/-	E R 200 YDS	-1.5	3.8	0.0	-16.5	-51.0	-110.0
Line of Sight	O 300 YDS	-1.5	9.3	11.0	0.0	-28.9	-82.4
Velocity, FPS		2200	1873	1580	1332	1144	1022
Energy, Ft-Lb Per Grain		10.75	7.79	5.54	3.94	2.91	2.32
Time of Flight, Seconds		0.0000	0.1478	0.3224	0.5295	0.7736	1.0522
Bullet Path	Z 100 YDS	-1.5	0.0	-8.5	-31.1	-73.4	-142.2
(Inches) +/-	E R 200 YDS	-1.5	4.3	0.0	-18.3	-56.4	-120.9
Line of Sight	O 300 YDS	-1.5	10.4	12.2	0.0	-31.9	-90.4

SPEER LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.24

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2100	1782	1502	1269	1102	995
Energy, Ft-Lb Per Grain			9.79	7.05	5.01	3.58	2.70	2.20
Time of Flight, Seconds			0.0000	0.1551	0.3387	0.5565	0.8114	1.0989
Bullet Path	Z	100 YDS	-1.5	0.0	-9.6	-34.7	-81.5	-156.8
(Inches) +/-	E R	200 YDS	-1.5	4.8	0.0	-20.3	-62.3	-132.9
Line of Sight	O	300 YDS	-1.5	11.6	13.6	0.0	-35.2	-99.0
Velocity, FPS			2000	1693	1425	1211	1064	970
Energy, Ft-Lb Per Grain			8.88	6.36	4.51	3.26	2.51	2.09
Time of Flight, Seconds			0.0000	0.1631	0.3565	0.5856	0.8511	1.1472
Bullet Path	Z	100 YDS	-1.5	0.0	-10.8	-38.8	-90.5	-172.9
(Inches) +/-	E R	200 YDS	-1.5	5.4	0.0	-22.6	-69.0	-146.0
Line of Sight	O	300 YDS	-1.5	12.9	15.1	0.0	-38.8	-108.3

Exterior Ballistic Table for Ballistic Coefficient 0.25

Velocity, FPS			4000	3524	3098	2711	2356	2028
Energy, Ft-Lb Per Grain			35.52	27.57	21.31	16.32	12.32	9.13
Time of Flight, Seconds			0.0000	0.0799	0.1708	0.2743	0.3931	0.5303
Bullet Path	Z	100 YDS	-1.5	0.0	-1.3	-6.3	-16.0	-32.0
(Inches) +/-	E R	200 YDS	-1.5	0.7	0.0	-4.3	-13.4	-28.7
Line of Sight	O	300 YDS	-1.5	2.1	2.9	0.0	-7.6	-21.6
Velocity, FPS			3900	3435	3017	2637	2288	1965
Energy, Ft-Lb Per Grain			33.77	26.20	20.21	15.44	11.62	8.57
Time of Flight, Seconds			0.0000	0.0820	0.1752	0.2816	0.4037	0.5453
Bullet Path	Z	100 YDS	-1.5	0.0	-1.5	-6.8	-17.1	-34.1
(Inches) +/-	E R	200 YDS	-1.5	0.7	0.0	-4.6	-14.2	-30.5
Line of Sight	O	300 YDS	-1.5	2.3	3.0	0.0	-8.1	-22.9
Velocity. FPS			3800	3345	2936	2563	2219	1902
Energy, Ft-Lb Per Grain			32.06	24.84	19.14	14.58	10.93	8.03
Time of Flight, Seconds			0.0000	0.0842	0.1799	0.2893	0.4151	0.5611
Bullet Path	Z	100 YDS	-1.5	0.0	-1.6	-7.3	-18.3	-36.4
(Inches) +/-	E R	200 YDS	-1.5	0.8	0.0	-4.9	-15.1	-32.4
Line of Sight	O	300 YDS	-1.5	2.4	3.2	0.0	-8.6	-24.3
Velocity, FPS			3700	3256	2855	2489	2150	1840
Energy, Ft-Lb Per Grain			30.39	23.54	18.10	13.75	10.26	7.52
Time of Flight, Seconds			0.0000	0.0865	0.1849	0.2975	0.4272	0.5781
Bullet Path	Z	100 YDS	-1.5	0.0	-1.8	-7.9	19.6	-39.0
(Inches) +/-	E R	200 YDS	-1.5	0.9	0.0	-5.2	-16.0	-34.5
Line of Sight	O	300 YDS	-1.5	2.6	3.5	0.0	-9.1	-25.8
Velocity, FPS			3600	3166	2773	2413	2081	1777
Energy Ft-Lb Per Grain			28.77	22.25	17.07	12.93	9.61	7.01
Time of Flight, Seconds			0.0000	0.0889	0.1902	0.3061	0.4400	0.5961
Bullet Path	Z	100 YDS	-1.5	0.0	-2.0	-8.5	-21.1	-41.7
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.5	-17.1	-36.8
Line of Sight	O	300 YDS	-1.5	2.8	3.7	0.0	-9.7	-27.5

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3500	3076	2691	2337	2011	1714
Energy, Ft-Lb Per Grain			27.20	21.01	16.08	12.13	8.98	6.52
Time of Flight, Seconds			0.0000	0.0915	0.1958	0.3154	0.4538	0.6155
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-9.2	-22.7	-44.8
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.9	-18.3	-39.3
Line of Sight	O	300 YDS	-1.5	3.1	4.0	0.0	-10.4	-29.4
Velocity, FPS			3400	2986	2609	2261	1941	1651
Energy Ft-Lb Per Grain			25.66	19.79	15.11	11.35	8.36	6.05
Time of Flight, Seconds			0.0000	0.0942	0.2017	0.3253	0.4685	0.6362
Bullet Path	Z	100 YDS	-1.5	0.0	-2.4	-10.0	-24.4	-48.2
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-6.4	-19.6	42.1
Line of Sight	O	300 YDS	-1.5	3.3	4.2	0.0	-11.1	-31.5
Velocity, FPS			3300	2895	2525	2184	1871	1589
Energy, Ft-Lb Per Grain			24.18	18.61	14.15	10.59	7.77	5.61
Time of Flight, Seconds			0.0000	0.0971	0.2081	0.3358	0.4843	0.6584
Bullet Path	Z	100 YDS	-1.5	0.0	-2.7	-10.8	-26.4	-51.9
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.8	-21.0	45.2
Line of Sight	O	300 YDS	-1.5	3.6	4.6	0.0	-11.9	-33.8
Velocity, FPS			3200	2804	2442	2107	1800	1528
Energy, Ft-Lb Per Grain			22.73	17.46	13.24	9.86	7.19	5.18
Time of Flight, Seconds			0.0000	0.1002	0.2148	0.3471	0.5012	0.6822
Bullet Path	Z	100 YDS	-1.5	0.0	-3.0	-11.8	-28.5	-56.1
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-7.4	-22.6	-48.7
Line of Sight	O	300 YDS	-1.5	3.9	4.9	0.0	-12.8	-36.4
Velocity, FPS			3100	2713	2358	2029	1730	1467
Energy, Ft-Lb Per Grain			21.33	16.34	12.34	9.14	6.64	4.78
Time of Flight, Seconds			0.0000	0.1035	0.2221	0.3593	0.5194	0.7079
Bullet Path	Z	100 YDS	-1.5	0.0	-3.3	-12.8	-30.9	-60.7
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.9	-24.4	-52.7
Line of Sight	O	300 YDS	-1.5	4.3	5.3	0.0	-13.8	-39.3
Velocity, FPS			3000	2622	2273	1952	1661	1408
Energy, Ft-Lb Per Grain			19.98	15.26	11.47	8.46	6.12	4.40
Time of Flight, Seconds			0.0000	0.1070	0.2299	0.3724	0.5391	0.7354
Bullet Path	Z	100 YDS	-1.5	0.0	-3.6	-14.0	-33.6	-65.9
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-8.6	-26.4	-56.9
Line of Sight	O	300 YDS	-1.5	4.7	5.7	0.0	-14.9	-42.6
Velocity, FPS			2900	2530	2188	1874	1592	1351
Energy, Ft-Lb Per Grain			18.67	14.21	10.63	7.80	5.63	4.05
Time of Flight, Seconds			0.0000	0.1108	0.2383	0.3865	0.5602	0.7651
Bullet Path	Z	100 YDS	-1.5	0.0	-4.0	-15.3	-36.6	-71.7
(Inches) +/-	E R	200 YDS	-1.5	2.0	0.0	-9.3	-28.6	-61.7
Line of Sight	O	300 YDS	-1.5	5.1	6.2	0.0	-16.2	-46.2

SPEER

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2800	2438	2103	1797	1525	1296
Energy, Ft-Lb Per Grain			17.41	13.20	9.82	7.17	5.16	3.73
Time of Flight, Seconds			0.0000	0.1148	0.2474	0.4017	0.5831	0.7969
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-4.4	-16.7	-39.9	-78.2
		200 YDS	-1.5	2.2	0.0	-10.1	-31.1	-67.2
		300 YDS	-1.5	5.6	6.8	0.0	-17.6	-50.3
Velocity, FPS			2700	2345	2018	1720	1459	1244
Energy, Ft-Lb Per Grain			16.18	12.21	9.04	6.57	4.73	3.44
Time of Flight, Seconds			0.0000	0.1192	0.2571	0.4182	0.6077	0.8310
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-4.9	-18.4	-43.7	-85.5
		200 YDS	-1.5	2.4	0.0	-11.0	-34.0	-73.3
		300 YDS	-1.5	6.1	7.4	0.0	-19.2	-54.9
Velocity, FPS			2600	2253	1933	1645	1395	1195
Energy, Ft-Lb Per Grain			15.01	11.27	8.30	6.01	4.32	3.17
Time of Flight, Seconds			0.0000	0.1240	0.2677	0.4360	0.6344	0.8675
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-5.4	-20.2	-48.0	-93.7
		200 YDS	-1.5	2.7	0.0	-12.1	-37.1	-80.2
		300 YDS	-1.5	6.7	8.1	0.0	-21.0	-60.1
Velocity, FPS			2500	2161	1849	1570	1333	1150
Energy, Ft-Lb Per Grain			13.88	10.37	7.59	5.47	3.94	2.94
Time of Flight, Seconds			0.0000	0.1291	0.2792	0.4554	0.6631	0.9062
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-6.0	-22.3	-52.8	-103.0
		200 YDS	-1.5	3.0	0.0	-13.3	-40.8	-87.9
		300 YDS	-1.5	7.4	8.8	0.0	-23.1	-65.8
Velocity, FPS			2400	2068	1766	1498	1274	1110
Energy, Ft-Lb Per Grain			12.79	9.49	6.92	4.98	3.60	2.74
Time of Flight, Seconds			0.0000	0.1347	0.2917	0.4763	0.6940	0.9472
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-6.7	-24.7	-58.2	-113.3
		200 YDS	-1.5	3.3	0.0	-14.6	-44.8	-96.6
		300 YDS	-1.5	8.2	9.7	0.0	-25.4	-72.2
Velocity, FPS			2300	1976	1683	1427	1219	1075
Energy, Ft-Lb Per Grain			11.74	8.67	6.29	4.52	3.30	2.57
Time of Flight, Seconds			0.0000	0.1407	0.3053	0.4991	0.7271	0.9903
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-7.5	-27.3	-64.4	-124.9
		200 YDS	-1.5	3.7	0.0	-16.1	-49.5	-106.2
		300 YDS	-1.5	9.1	10.8	0.0	-28.0	-79.3
Velocity, FPS			2200	1885	1602	1359	1169	1042
Energy, Ft-Lb Per Grain			10.75	7.89	5.70	4.10	3.03	2.41
Time of Flight, Seconds			0.0000	0.1473	0.3201	0.5237	0.7626	1.0354
Bullet Path (Inches) +/- Line of Sight	ZERO	100 YDS	-1.5	0.0	-8.4	-30.4	-71.4	-137.8
		200 YDS	-1.5	4.2	0.0	-17.9	-54.7	-116.9
		300 YDS	-1.5	10.1	11.9	0.0	-30.8	-87.1

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.25

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2100	1794	1522	1294	1124	1013
Energy, Ft-Lb Per Grain			9.79	7.15	5.14	3.72	2.80	2.28
Time of Flight, Seconds			0.0000	0.1546	0.3363	0.5504	0.8002	1.0824
Bullet Path	ZERO	100 YDS	-1.5	0.0	-9.4	-33.9	-79.3	-152.2
(Inches) +/-		200 YDS	-1.5	4.7	0.0	-19.8	-60.5	-128.7
Line of Sight		300 YDS	-1.5	11.3	13.2	0.0	-34.1	-95.6
Velocity, FPS			2000	1704	1445	1233	1083	987
Energy, Ft-Lb Per Grain			8.88	6.45	4.64	3.38	2.60	2.16
Time of Flight, Seconds			0.0000	0.1626	0.3540	0.5793	0.8400	1.1311
Bullet Path	ZERO	100 YDS	-1.5	0.0	-10.6	-37.9	-88.2	-168.1
(Inches) +/-		200 YDS	-1.5	5.3	0.0	-22.1	-67.1	- 141.6
Line of Sight		300 YDS	-1.5	12.6	14.7	0.0	-37.6	-104.8

Exterior Ballistic Table for Ballistic Coefficient 0.26

Velocity, FPS			3600	3182	2802	2453	2130	1833
Energy, Ft-Lb Per Grain			28.77	22.48	17.43	13.36	10.07	7.46
Time of Flight, Seconds			0.0000	0.0887	0.1892	0.3036	0.4348	0.5867
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.0	-8.4	-20.6	-40.5
(Inches) +/-		200 YDS	-1.5	1.0	0.0	-5.4	-16.7	-35.6
Line of Sight		300 YDS	-1.5	2.8	3 6	0.0	-9.4	-26.6
Velocity, FPS			3500	3092	2720	2377	2059	1768
Energy, Ft-Lb Per Grain			27.20	21.22	16.42	12.54	9.41	6.94
Time of Flight, Seconds			0.0000	0.0912	0.1947	0.3127	0.4483	0.6056
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.2	-9.0	-22.1	-43.5
(Inches) +/-		200 YDS	-1.5	1.1	0.0	-5.8	-17.8	-38.1
Line of Sight		300 YDS	-1.5	3.0	3.9	0.0	-10.1	-28.4
Velocity, FPS			3400	3001	2636	2300	1988	1704
Energy, Ft-Lb Per Grain			25.66	19.99	15.43	11.74	8.77	6.45
Time of Flight, Seconds			0.0000	0.0940	0.2006	0.3225	0.4628	0.6258
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.4	-9.8	-23.8	-46.8
(Inches) +/-		200 YDS	-1.5	1.2	0.0	-6.2	-19.1	-40.8
Line of Sight		300 YDS	-1.5	3.3	4.2	0.0	-10.8	-30.4
Velocity, FPS			3300	2910	2553	2222	1917	1640
Energy, Ft-Lb Per Grain			24.18	18.80	14.47	10.96	8.16	5.97
Time of Flight, Seconds			0.0000	0.0968	0.2069	0.3329	0.4783	0.6476
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.6	-10.6	-25.7	-50.4
(Inches) +/-		200 YDS	-1.5	1.3	0.0	-6.7	-20.5	-43.8
Line of Sight		300 YDS	-1.5	3.5	4.5	0.0	-11.6	-32.7
Velocity, FPS			3200	2819	2469	2144	1846	1577
Energy Ft-Lb Per Grain			22.73	17.64	13.53	10.21	7.57	5.52
Time of Flight, Seconds			0.0000	0.0999	0.2137	0.3441	0.4949	0.6709
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.9	-11.5	-27.8	-54.4
(Inches) +/-		200 YDS	-1.5	1.5	0.0	-7.2	-22.0	-47.1
Time of Sight		300 YDS	-1.5	3.8	4.8	0.0	-12.4	-35.1

Exterior Ballistic Table for Ballistic Coefficient 0.26

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3100	2727	2384	2066	1774	1515
Energy, Ft-Lb Per Grain			21.33	16.51	12.62	9.48	6.99	5.10
Time of Flight, Seconds			0.0000	0.1032	0.2209	0.3561	0.5128	0.6959
Bullet Path	Z	100 YDS	-1.5	0.0	-3.2	-12.6	-30.1	-58.9
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.8	-23.7	-50.9
Line of Sight	O	300 YDS	-1.5	4.2	5.2	0.0	-13.4	-37.9
Velocity, FPS			3000	2636	2299	1987	1704	1454
Energy, Ft-Lb Per Grain			19.98	15.43	11.73	8.77	6.45	4.69
Time of Flight, Seconds			0.0000	0.1067	0.2286	0.3690	0.5321	0.7229
Bullet Path	Z	100 YDS	-1.5	0.0	-3.5	-13.7	-32.7	-63.9
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-8.4	-25.7	-55.0
Line of Sight	O	300 YDS	-1.5	4.6	5.6	0.0	-14.5	-41.0
Velocity, FPS			2900	2543	2213	1909	1633	1394
Energy, Ft-Lb Per Grain			18.67	14.36	10.87	8.09	5.92	4.31
Time of Flight, Seconds			0.0000	0.1105	0.2369	0.3829	0.5529	0.7520
Bullet Path	Z	100 YDS	-1.5	0.0	-3.9	-15.0	-35.7	-69.5
(Inches) +/-	E R	200 YDS	-1.5	2.0	0.0	-9.1	-27.8	-59.7
Line of Sight	O	300 YDS	-1.5	5.0	6.1	0.0	-15.7	-44.5
Velocity, FPS			2800	2451	2128	1831	1564	1336
Energy, Ft-Lb Per Grain			17.41	13.34	10.05	7.44	5.43	3.96
Time of Flight, Seconds			0.0000	0.1145	0.2459	0.3979	0.5753	0.7832
Bullet Path	Z	100 YDS	-1.5	0.0	-4.3	-16.4	-38.9	-75.8
(Inches) +/-	E R	200 YDS	-1.5	2.2	0.0	-9.9	-30.3	-65.0
Line of Sight	O	300 YDS	-1.5	5.5	6.6	0.0	-17.1	-48.5
Velocity, FPS			2700	2359	2042	1753	1496	1281
Energy, Ft-Lb Per Grain			16.18	12.35	9.26	6.82	4.97	3.64
Time of Flight, Seconds			0.0000	0.1189	0.2556	0.4142	0.5996	0.8167
Bullet Path	Z	100 YDS	-1.5	0.0	-4.8	-18.0	-42.6	-82.9
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-10.8	-33.0	-70.9
Line of Sight	O	300 YDS	-1.5	6.0	7.2	0.0	-18.6	-52.9
Velocity, FPS			2600	2266	1957	1676	1430	1229
Energy, Ft-Lb Per Grain			15.01	11.40	8.50	6.24	4.54	3.35
Time of Flight, Seconds			0.0000	0.1236	0.2661	0.4318	0.6258	0.8526
Bullet Path	Z	100 YDS	-1.5	0.0	-5.3	-19.8	-46.8	-90.8
(Inches) +/-	E R	200 YDS	-1.5	2.7	0.0	-11.8	-36.1	-77.5
Line of Sight	O	300 YDS	-1.5	6.6	7.9	0.0	-20.4	-57.8
Velocity, FPS			2500	2173	1872	1601	1366	1180
Energy, Ft-Lb Per Grain			13.88	10.48	7.78	5.69	4.14	3.09
Time of Flight, Seconds			0.0000	0.1287	0.2775	0.4509	0.6540	0.8910
Bullet Path	Z	100 YDS	-1.5	0.0	-5.9	-21.8	-51.5	-99.8
(Inches) +/-	E R	200 YDS	-1.5	3.0	0.0	- 13.0	-39.6	-85.0
Line of Sight	O	300 YDS	-1.5	7.3	8.6	0.0	-22.3	-63.4

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3800	3377	2995	2644	2318	2016
Energy, Ft-Lb Per Grain			32.06	25.32	19.91	15.52	11.93	9.02
Time of Flight, Seconds			0.0000	0.0838	0.1781	0.2848	0.4060	0.5448
Bullet Path	Z	100 YDS	-1.5	0.0	-1.6	-7.0	-17.5	-34.5
(Inches) +/-	E R	200 YDS	-1.5	0.8	0.0	-4.7	-14.4	-30.6
Line of Sight	O	300 YDS	-1.5	2.3	3.1	0.0	-8.1	-22.8
Velocity, FPS			3700	3287	2912	2567	2248	1951
Energy, Ft-Lb Per Grain			30.39	23.99	18.83	14.63	11.22	8.45
Time of Flight, Seconds			0.0000	0.0861	0.1830	0.2928	0.4177	0.5610
Bullet Path	Z	100 YDS	-1.5	0.0	-1.7	-7.6	-18.7	-36.8
(Inches) +/-	E R	200 YDS	-1.5	0.9	0.0	-5.0	-15.3	-32.5
Line of Sight	O	300 YDS	-1.5	2.5	3.3	0.0	-8.6	-24.2
Velocity, FPS			3600	3197	2829	2491	2176	1886
Energy, Ft-Lb Per Grain			28.77	22.69	17.77	13.78	10.51	7.90
Time of Flight, Seconds			0.0000	0.0885	0.1882	0.3013	0.4301	0.5782
Bullet Path	Z	100 YDS	-1.5	0.0	-1.9	-8.2	-20.1	-39.4
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.3	-16.3	-34.7
Line of Sight	O	300 YDS	-1.5	2.7	3.6	0.0	-9.2	-25.8
Velocity, FPS			3500	3106	2746	2414	2105	1820
Energy, Ft-Lb Per Grain			27.20	21.42	16.74	12.94	9.84	7.35
Time of Flight, Seconds			0.0000	0.0910	0.1938	0.3103	0.4434	0.5967
Bullet Path	Z	100 YDS	-1.5	0.0	-2.1	-8.9	-21.6	-42.3
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.7	-17.4	-37.0
Line of Sight	O	300 YDS	-1.5	3.0	3.8	0.0	-9.8	-27.5
Velocity, FPS			3400	3015	2662	2336	2033	1754
Energy, Ft-Lb Per Grain			25.66	20.18	15.73	12.11	9.18	6.83
Time of Flight, Seconds			0.0000	0.0937	0.1996	0.3199	0.4576	0.6165
Bullet Path	Z	100 YDS	-1.5	0.0	-2.3	-9.6	-23.3	-45.5
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-6.1	-18.6	-39.6
Line of Sight	O	300 YDS	-1.5	3.2	4.1	0.0	-10.5	-29.5
Velocity, FPS			3300	2924	2578	2258	1960	1689
Energy, Ft-Lb Per Grain			24.18	18.98	14.75	11.32	8.53	6.33
Time of Flight, Seconds			0.0000	0.0966	0.2059	0.3302	0.4729	0.6378
Bullet Path	Z	100 YDS	-1.5	0.0	-2.6	-10.4	-25.2	-49.0
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.6	-20.0	-42.5
Line of Sight	O	300 YDS	-1.5	3.5	4.4	0.0	-11.2	-31.6
Velocity, FPS			3200	2832	2494	2179	1888	1624
Energy, Ft-Lb Per Grain			22.73	17.81	13.81	10.54	7.91	5.86
Time of Flight, Seconds			0.0000	0.0997	0.2126	0.3413	0.4892	0.6606
Bullet Path	Z	100 YDS	-1.5	0.0	-2.9	-11.3	-27.2	-52.9
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-7.1	-21.5	-45.8
Line of Sight	O	300 YDS	-1.5	3.8	4.7	0.0	-12.1	-34.0

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3100	2741	2408	2100	1816	1560
Energy, Ft-Lb Per Grain		21.33	16.68	12.87	9.79	7.32	5.40
Time of Flight, Seconds		0.0000	0.1029	0.2197	0.3531	0.5068	0.6852
Bullet Path	Z 100 YDS	-1.5	0.0	-3.2	-12.3	-29.5	-57.2
(Inches) +/-	E R 200 YDS	-1.5	1.6	0.0	-7.6	-23.2	-49.4
Line of Sight	O 300 YDS	-1.5	4.1	5.1	0.0	-13.0	-36.7
Velocity, FPS		3000	2649	2323	2021	1744	1497
Energy, Ft-Lb Per Grain		19.98	15.58	11.98	9.07	6.75	4.98
Time of Flight, Seconds		0.0000	0.1064	0.2274	0.3659	0.5258	0.7116
Bullet Path	Z 100 YDS	-1.5	0.0	-3.5	-13.5	-32.0	-62.1
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-8.2	-25.0	-53.4
Line of Sight	O 300 YDS	-1.5	4.5	5.5	0.0	-14.1	-39.7
Velocity, FPS		2900	2556	2237	1941	1672	1435
Energy, Ft-Lb Per Grain		18.67	14.50	11.11	8.36	6.21	4.57
Time of Flight, Seconds		0.0000	0.1102	0.2357	0.3796	0.5462	0.7401
Bullet Path	Z 100 YDS	-1.5	0.0	-3.9	-14.7	-34.9	-67.5
(Inches) +/-	E R 200 YDS	-1.5	1.9	0.0	-8.9	-27.1	-57.9
Line of Sight	O 300 YDS	-1.5	4.9	5.9	0.0	-15.2	-43.0
Velocity, FPS		2800	2464	2151	1862	1602	1375
Energy, Ft-Lb Per Grain		17.41	13.48	10.27	7.70	5.70	4.20
Time of Flight, Seconds		0.0000	0.1142	0.2446	0.3945	0.5683	0.7707
Bullet Path	Z 100 YDS	-1.5	0.0	-4.3	-16.1	-38.0	-73.6
(Inches) +/-	E R 200 YDS	-1.5	2.1	0.0	-9.7	-29.5	-63.0
Line of Sight	O 300 YDS	-1.5	5.4	6.5	0.0	-16.6	-46.8
Velocity, FPS		2700	2371	2065	1784	1532	1317
Energy, Ft-Lb Per Grain		16.18	12.48	9.47	7.07	5.21	3.85
Time of Flight, Seconds		0.0000	0.1186	0.2542	0.4105	0.5921	0.8037
Bullet Path	Z 100 YDS	-1.5	0.0	-4.7	-17.7	-41.6	-80.5
(Inches) +/-	E R 200 YDS	-1.5	2 4	0.0	-10.6	-32.2	-68.7
Line of Sight	O 300 YDS	-1.5	5.9	7.1	0.0	-18.1	-51.1
Velocity, FPS		2600	2278	1979	1706	1464	1262
Energy, Ft-Lb Per Grain		15.01	11.52	8.69	6.46	4.76	3.54
Time of Flight, Seconds		0.0000	0.1233	0.2646	0.4279	0.6179	0.8391
Bullet Path	Z 100 YDS	-1.5	0.0	-5.2	-19.4	-45.7	-88.2
(Inches) +/-	E R 200 YDS	-1.5	2.6	0.0	-11.6	-35.2	-75.1
Line of Sight	O 300 YDS	-1.5	6.5	7.7	0.0	-19.8	-55.8
Velocity, FPS		2500	2185	1893	1629	1398	1210
Energy, Ft-Lb Per Grain		13.88	10.60	7.96	5.89	4.34	3.25
Time of Flight, Seconds		0.0000	0.1284	0.2759	0.4468	0.6458	0.8770
Bullet Path	Z 100 YDS	-1.5	0.0	-5.8	-21.4	-50.3	-97.0
(Inches) +/-	E R 200 YDS	-1.5	2.9	0.0	-12.7	-38.6	-82.4
Line of Sight	O 300 YDS	-1.5	7.1	8.5	0.0	-21.7	-61.2

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE	ZERO	MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity. FPS		2400	2092	1808	1554	1335	1163
Energy, Ft-Lb Per Grain		12.79	9.72	7.26	5.36	3.96	3.00
Time of Flight, Seconds		0.0000	0.1339	0.2882	0.4672	0.6759	0.9173
Bullet Path	100 YDS	-1.5	0.0	-6.5	-23.7	-55.4	-106.8
(Inches) +/-	200 YDS	-1.5	3.3	0.0	-14.0	-42.4	-90.5
Line of Sight	300 YDS	-1.5	7.9	9.3	0.0	-23.8	-67.2
Velocity. FPS		2300	1999	1724	1480	1275	1121
Energy, Ft-Lb Per Grain		11.74	8.87	6.60	4.86	3.61	2.79
Time of Flight, Seconds		0.0000	0.1399	0.3015	0.4895	0.7083	0.9601
Bullet Path	100 YDS	-1.5	0.0	-7.3	-26.3	-61.3	-117.8
(Inches) +/-	200 YDS	-1.5	3.6	0.0	-15.4	-46.8	-99.7
Line of Sight	300 YDS	-1.5	8.8	10.3	0.0	-26.3	-74.0
Velocity, FPS		2200	1907	1642	1409	1219	1083
Energy, Ft-Lb Per Grain		10.75	8.07	5.99	4.41	3.30	2.60
Time of Flight, Seconds		0.0000	0.1465	0.3161	0.5136	0.7431	1.0052
Bullet Path	100 YDS	-1.5	0.0	-8.1	-29.3	-68.0	-130.2
(Inches) +/-	200 YDS	-1.5	4.1	0.0	-17.1	-51.8	-109.9
Line of Sight	300 YDS	-1.5	9.8	11.4	0.0	-29.0	-81.4
Velocity, FPS		2100	1816	1560	1340	1167	1049
Energy, Ft-Lb Per Grain		9.79	7.32	5.40	3.99	3.02	2.44
Time of Flight, Seconds		0.0000	0.1537	0.3320	0.5398	0.7804	1.0525
Bullet Path	100 YDS	-1.5	0.0	-9.1	-32.6	-75.6	-144.1
(Inches) +/-	200 YDS	-1.5	4.6	0.0	-19.0	-57.4	-121.3
Line of Sight	300 YDS	-1.5	10.9	12.6	0.0	-32.1	-89.7
Velocity, FPS		2000	1725	1481	1275	1121	1018
Energy, Ft-Lb Per Grain		8.88	6.61	4.87	3.61	2.79	2.30
Time of Flight, Seconds		0.0000	0.1616	0.3495	0.5682	0.8200	1.1017
Bullet Path	100 YDS	-1.5	0.0	-10.3	-36.5	-84.2	-159.5
(Inches) +/-	200 YDS	-1.5	5.1	0.0	-21.1	-63.7	-133.8
Line of Sight	300 YDS	-1.5	12.2	14.1	0.0	-35.5	-98.7
Velocity, FPS		1900	1635	1403	1214	1080	990
Energy, Ft-Lb Per Grain		8.01	5.93	4.37	3.27	2.59	2.18
Time of Flight, Seconds		0.0000	0.1703	0.3686	0.5990	0.8619	1.1529
Bullet Path	100 YDS	-1.5	0.0	-11.6	-41.0	93.9	-176.7
(Inches) +/-	200 YDS	-1.5	5.8	0.0	-23.6	-70.7	-147.7
Line of Sight	300 YDS	-1.5	13.7	15.7	0.0	-39.3	-108.4
Velocity, FPS		1800	1546	1329	1159	1043	964
Energy, Ft-Lb Per Grain		7.19	5.31	3.92	2.98	2.42	2.06
Time of Flight, Seconds		0.0000	0.1799	0.3895	0.6320	0.9058	1.2057
Bullet Path	100 YDS	-1.5	0.0	-13.1	-46.1	-104.9	-195.6
(Inches) +/-	200 YDS	-1.5	6.6	0.0	-26.4	-78.6	-162.7
Line of Sight	300 YDS	-1.5	15.4	17.6	0.0	-43.4	-118.8

SPEER

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.27

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		1700	1459	1258	1109	1010	940
Energy, Ft-Lb Per Grain		6.42	4.73	3.51	2.73	2.26	1.96
Time of Flight, Seconds		0.0000	0.1906	0.4125	0.6674	0.9517	1.2602
Bullet Path	Z 100 YDS	-1.5	0.0	-14.9	-51.9	-117.1	-216.3
(Inches) +/-	E R 200 YDS	-1.5	7.5	0.0	-29.5	-87.2	-178.9
Line of Sight	O 300 YDS	-1.5	17.3	19.7	0.0	-47.9	-129.8
Velocity, FPS		1600	1373	1192	1065	980	916
Energy, Ft-Lb Per Grain		5.68	4.19	3.15	2.52	21.3	1.86
Time of Flight, Seconds		0.0000	0.2026	0.4377	0.7050	0.9994	1.3167
Bullet Path	Z 100 YDS	-1.5	0.0	-17.0	-58.5	-130.6	-239.0
(Inches) +/-	E R 200 YDS	-1.5	8.5	0.0	-33.0	-96.6	-196.4
Line of Sight	O 300 YDS	-1.5	19.5	22.0	0.0	-52.6	-141.4
Velocity, FPS		1500	1291	1132	1025	951	893
Energy, Ft-Lb Per Grain		5.00	3.70	2.84	2.33	2.01	1.77
Time of Flight, Seconds		0.0000	0.2160	0.4650	0.7444	1.0489	1.3749
Bullet Path	Z 100 YDS	-1.5	0.0	-19.4	-66.0	-145.6	-263.6
(Inches) +/-	E R 200 YDS	-1.5	9.7	0.0	-36.8	-106.7	-215.0
Line of Sight	O 300 YDS	-1.5	22.0	24.5	0.0	-57.6	-153.6

Exterior Ballistic Table for Ballistic Coefficient 0.30

Velocity, FPS		3800	3418	3068	2746	2446	2164
Energy, Ft-Lb Per Grain		32.06	25.94	20.90	16.74	13.28	10.40
Time of Flight, Seconds		0.0000	0.0833	0.1759	0.2793	0.3951	0.5255
Bullet Path	Z 100 YDS	-1.5	0.0	-1.5	-6.7	-16.5	-32.2
(Inches) +/-	E R 200 YDS	-1.5	0.7	0.0	-4.5	-13.5	-28.5
Line of Sight	O 300 YDS	-1.5	2.2	3.0	0.0	-7.6	-21.0
Velocity, FPS		3700	3327	2985	2668	2373	2096
Energy, Ft-Lb Per Grain		30.39	24.57	19.78	15.80	12.50	9.75
Time of Flight, Seconds		0.0000	0.0855	0.1808	0.2871	0.4063	0.5409
Bullet Path	Z 100 YDS	-1.5	0.0	-1.7	-7.2	-17.7	-34.4
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-4.7	-14.4	-30.3
Line of Sight	O 300 YDS	-1.5	2.4	3.2	0.0	-8.1	-22.3
Velocity, FPS		3600	3235	2900	2590	2299	2028
Energy, Ft-Lb Per Grain		28.77	23.23	18.67	14.89	11.73	9.13
Time of Flight, Seconds		0.0000	0.0879	0.1859	0.2954	0.4183	0.5573
Bullet Path	Z 100 YDS	-1.5	0.0	-1.8	-7.8	-19.0	-36.8
(Inches) +/-	E R 200 YDS	-1.5	0.9	0.0	-5.1	-15.3	-32.2
Line of Sight	O 300 YDS	-1.5	2.6	3.4	0.0	-8.6	-23.8
Velocity, FPS		3500	3144	2816	2511	2225	1959
Energy, Ft-Lb Per Grain		27.20	21.94	17.60	14.00	10.99	8.52
Time of Flight, Seconds		0.0000	0.0905	0.1913	0.3042	0.4311	0.5748
Bullet Path	Z 100 YDS	-1.5	0.0	-2.0	-8.5	-20.4	-39.5
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-5.4	-16.4	-34.4
Line of Sight	O 300 YDS	-1.5	2.8	3.6	0.0	-9.2	-25.4

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.30

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity. FPS		3400	3052	2731	2431	2151	1890
Energy, Ft-Lb Per Grain		25.66	20.68	16.56	13.12	10.27	7.93
Time of Flight, Seconds		0.0000	0.0932	0.1971	0.3135	0.4447	0.5935
Bullet Path	Z 100 YDS	-1.5	0.0	-2.2	-9.2	-22.0	-42.4
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.8	-17.5	-36.8
Line of Sight	O 300 YDS	-1.5	3.1	3.9	0.0	-9.8	-27.1
Velocity, FPS		3300	2960	2645	2351	2076	1821
Energy, Ft-Lb Per Grain		24.18	19.45	15.53	12.27	9.57	7.36
Time of Flight, Seconds		0.0000	0.0960	0.2032	0.3235	0.4593	0.6136
Bullet Path	Z 100 YDS	-1.5	0.0	-2.5	-10.0	-23.8	-45.7
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-6.2	-18.8	-39.5
Line of Sight	O 300 YDS	-1.5	3.3	4.2	0.0	-10.5	-29.1
Velocity, FPS		3200	2868	2559	2271	2001	1752
Energy, Ft-Lb Per Grain		22.73	18.26	14.54	11.45	8.89	6.81
Time of Flight, Seconds		0.0000	0.0991	0.2098	0.3342	0.4750	0.6352
Bullet Path	Z 100 YDS	-1.5	0.0	-2.7	-10.8	-25.7	-49.3
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-6.7	-20.2	-42.4
Line of Sight	O 300 YDS	-1.5	3.6	4.5	0.0	-11.3	-31.2
Velocity, FPS		3100	2775	2473	2190	1926	1684
Energy, Ft-Lb Per Grain		21.33	17.10	13.58	10.65	8.24	6.30
Time of Flight, Seconds		0.0000	0.1023	0.2168	0.3457	0.4918	0.6585
Bullet Path	Z 100 YDS	-1.5	0.0	-3.0	-11.8	-27.8	-53.3
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-7.2	-21.8	-45.7
Line of Sight	O 300 YDS	-1.5	3.9	4.8	0.0	-12.1	-33.7
Velocity, FPS		3000	2682	2386	2109	1851	1616
Energy, Ft-Lb Per Grain		19.98	15.97	12.64	9.87	7.61	5.80
Time of Flight, Seconds		0.0000	0.1058	0.2244	0.3581	0.5100	0.6835
Bullet Path	Z 100 YDS	-1.5	0.0	-3.4	-12.8	-30.2	-57.8
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-7.8	-23.5	-49.4
Line of Sight	O 300 YDS	-1.5	4.3	5.2	0.0	-13.1	-36.4
Velocity, FPS		2900	2589	2299	2028	1776	1549
Energy, Ft-Lb Per Grain		18.67	14.88	11.73	9.13	7.00	5.33
Time of Flight, Seconds		0.0000	0.1095	0.2325	0.3714	0.5295	0.7105
Bullet Path	Z 100 YDS	-1.5	0.0	-3.7	-14.0	-32.9	-62.8
(Inches) +/-	E R 200 YDS	-1.5	1.9	0.0	-8.5	-25.4	-53.5
Line of Sight	O 300 YDS	-1.5	4.7	5.6	0.0	-14.2	-39.4
Velocity, FPS		2800	2496	2212	1946	1702	1483
Energy, Ft-Lb Per Grain		17.41	13.83	10.86	8.41	6.43	4.88
Time of Flight, Seconds		0.0000	0.1135	0.2412	0.3858	0.5507	0.7396
Bullet Path	Z 100 YDS	-1.5	0.0	-4.1	-15.4	-35.9	-68.4
(Inches) +/-	E R 200 YDS	-1.5	2.1	0.0	-9.2	-27.6	-58.2
Line of Sight	O 300 YDS	-1.5	5.1	6.1	0.0	-15.4	-42.8

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.30

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2700	2403	2124	1865	1629	1419
Energy, Ft-Lb Per Grain			16.18	12.82	10.02	7.72	5.89	4.47
Time of Flight, Seconds			0.0000	0.1178	0.2506	0.4013	0.5735	0.7710
Bullet Path	Z	100 YDS	-1.5	0.0	-4.6	-16.9	-39.2	-74.8
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-10.0	-30.1	-63.4
Line of Sight	O	300 YDS	-1.5	5.6	6.7	0.0	-16.7	-46.7
Velocity, FPS			2600	2309	2037	1785	1557	1357
Energy, Ft-Lb Per Grain			15.01	11.84	9.21	7.07	5.38	4.09
Time of Flight, Seconds			0.0000	0.1224	0.2608	0.4182	0.5983	0.8049
Bullet Path	Z	100 YDS	-1.5	0.0	-5.1	-18.5	-43.0	-81.9
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-11.0	-32.9	-69.3
Line of Sight	O	300 YDS	-1.5	6.2	7.3	0.0	-18.3	-51.0
Velocity, FPS			2500	2215	1950	1705	1486	1298
Energy, Ft-Lb Per Grain			13.88	10.89	8.44	6.45	4.90	3.74
Time of Flight, Seconds			0.0000	0.1275	0.2719	0.4364	0.6250	0.8413
Bullet Path	Z	100 YDS	-1.5	0.0	-5.6	-20.5	-47.3	-90.0
(Inches) +/-	E R	200 YDS	-1.5	2.8	0.0	-12.0	-36.1	-75.9
Line of Sight	O	300 YDS	-1.5	6.8	8.0	0.0	-20.0	-55.9
Velocity, FPS			2400	2122	1863	1627	1418	1242
Energy, Ft-Lb Per Grain			12.79	10.00	7.71	5.88	4.46	3.42
Time of Flight, Seconds			0.0000	0.1330	0.2839	0.4563	0.6540	0.8805
Bullet Path	Z	100 YDS	-1.5	0.0	-6.3	-22.6	-52.2	-99.1
(Inches) +/-	E R	200 YDS	-1.5	3.1	0.0	-13.2	-39.6	-83.5
Line of Sight	O	300 YDS	-1.5	7.5	8.8	0.0	-22.0	-61.4
Velocity, FPS			2300	2028	1777	1550	1351	1191
Energy, Ft-Lb Per Grain			11.74	9.13	7.01	5.33	4.05	3.15
Time of Flight, Seconds			0.0000	0.1389	0.2969	0.4778	0.6853	0.9224
Bullet Path	Z	100 YDS	-1.5	0.0	-7.0	-25.1	-57.7	-109.5
(Inches) +/-	E R	200 YDS	-1.5	3.5	0.0	-14.6	-43.7	-92.0
Line of Sight	O	300 YDS	-1.5	8.4	9.7	0.0	-24.3	-67.7
Velocity, FPS			2200	1935	1692	1475	1289	1144
Energy, Ft-Lb Per Grain			10.75	8.31	6.36	4.83	3.69	2.91
Time of Flight, Seconds			0.0000	0.1454	0.3112	0.5013	0.7192	0.9670
Bullet Path	Z	100 YDS	-1.5	0.0	-7.8	-27.9	-64.0	-121.1
(Inches) +/-	E R	200 YDS	-1.5	3.9	0.0	-16.1	-48.3	-101.5
Line of Sight	O	300 YDS	-1.5	9.3	10.8	0.0	-26.8	-74.7
Velocity, FPS			2100	1843	1609	1402	1230	1102
Energy, Ft-Lb Per Grain			9.79	7.54	5.75	4.36	3.36	2.70
Time of Flight, Seconds			0.0000	0.1525	0.3268	0.5268	0.7557	1.0142
Bullet Path	Z	100 YDS	-1.5	0.0	-8.8	-31.1	-71.2	-134.3
(Inches) +/-	E R	200 YDS	-1.5	4.4	0.0	-17.9	-53.6	-112.3
Line of Sight	O	300 YDS	-1.5	10.4	11.9	0.0	-29.7	-82.5

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.30

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2000	1751	1527	1332	1176	1064
Energy, Ft-Lb Per Grain		8.88	6.81	5.18	3.94	3.07	2.51
Time of Flight, Seconds		0.0000	0.1603	0.3439	0.5546	0.7949	1.0639
Bullet Path	Z 100 YDS	-1.5	0.0	-9.9	-34.8	-79.4	-149.1
(Inches) +/-	E 200 YDS	-1.5	5.0	0.0	-20.0	-59.6	-124.4
Line of Sight	R O 300 YDS	-1.5	11.6	13.3	0.0	-33.0	-91.1
Velocity, FPS		1900	1660	1447	1266	1127	1031
Energy, Ft-Lb Per Grain		8.01	6.12	4.65	3.56	2.82	2.36
Time of Flight, Seconds		0.0000	0.1690	0.3627	0.5848	0.8367	1.1158
Bullet Path	Z 100 YDS	-1.5	0.0	-11.2	-39.1	-88.7	-165.7
(Inches) +/-	E 200 YDS	-1.5	5.6	0.0	-22.3	-66.3	-137.7
Line of Sight	R O 300 YDS	-1.5	13.0	14.9	0.0	-36.6	-100.6
Velocity, FPS		1800	1570	1369	1204	1084	1001
Energy, Ft-Lb Per Grain		7.19	5.47	4.16	3.22	2.61	2.22
Time of Flight, Seconds		0.0000	0.1785	0.3834	0.6176	0.8810	1.1698
Bullet Path	Z 100 YDS	-1.5	0.0	-12.7	-44.0	-99.3	-184.2
(Inches) +/-	E 200 YDS	-1.5	6.3	0.0	-25.0	-73.9	-152 5
Line of Sight	R O 300 YDS	-1.5	14.7	16.7	0.0	-40.6	-110.9
Velocity, FPS		1700	1482	1294	1148	1045	973
Energy, Ft-Lb Per Grain		6.42	4.88	3.72	2.93	2.42	2.10
Time of Flight, Seconds		0.0000	0.1892	0.4061	0.6529	0.9276	1.2258
Bullet Path	Z 100 YDS	-1.5	0.0	-14.4	-49.7	-111.3	-204.7
(Inches) +/-	E 200 YDS	-1.5	7.2	0.0	-28.0	-82.4	-168.6
Line of Sight	R O 300 YDS	-1.5	16.6	18.7	0.0	-45.1	-121.9
Velocity, FPS		1600	1394	1224	1097	1010	946
Energy, Ft-Lb Per Grain		5.68	4.31	3.33	2.67	2.26	1.99
Time of Flight, Seconds		0.0000	0.2010	0.4311	0.6908	0.9764	1.2838
Bullet Path	Z 100 YDS	-1.5	0.0	-16.5	-56.2	-124.7	227.3
(Inches) +/-	E 200 YDS	-1.5	8.2	0.0	-31.5	-91.8	-186.1
Line of Sight	R O 300 YDS	-1.5	18.7	21.0	0.0	-49.8	-133.7
Velocity, FPS		1500	1309	1159	1053	978	921
Energy, Ft-Lb Per Grain		5.00	3.80	2.98	2.46	2.12	1.88
Time of Flight, Seconds		0.0000	0.2143	0.4585	0.7308	1.0271	1.3437
Bullet Path	Z 100 YDS	-1.5	0.0	-18.8	-63.5	-139.6	-251.9
(Inches) +/-	E 200 YDS	-1.5	9.4	0.0	-35.3	-101.9	-204.8
Line of Sight	R O 300 YDS	-1.5	21.2	23.5	0.0	-54.9	-146.0

Exterior Ballistic Table for Ballistic Coefficient 0.32

Velocity, FPS		3600	3257	2941	2646	2370	2111
Energy, Ft-Lb Per Grain		28.77	23.55	19.20	15.54	12.47	9.89
Time of Flight, Seconds		0.0000	0.0876	0.1846	0.2921	0.4119	0.5461
Bullet Path	Z 100 YDS	-1.5	0.0	-1.8	-7.6	-18.4	-35.4
(Inches) +/-	E 200 YDS	-1.5	0.9	0.0	-4.9	-14.8	-31.0
Line of Sight	R O 300 YDS	-1.5	2.5	3.3	0.0	-8.3	-22.8

Exterior Ballistic Table for Ballistic Coefficient 0.32

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3500	3165	2855	2566	2295	2040
Energy, Ft-Lb Per Grain			27.20	22.24	18.10	14.62	11.69	9.24
Time of Flight, Seconds			0.0000	0.0902	0.1900	0.3008	0.4244	0.5631
Bullet Path	Z	100 YDS	-1.5	0.0	-2.0	-8.2	-19.8	-38.0
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.3	-15.8	-33.0
Line of Sight	O	300 YDS	-1.5	2.7	3.5	0.0	-8.8	-24.3
Velocity. FPS			3400	3073	2770	2486	2219	1970
Energy. Ft-Lb Per Grain			25.66	20.96	17.03	13.72	10.93	8.62
Time of Flight, Seconds			0.0000	0.0928	0.1957	0.3100	0.4377	0.5813
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-8.9	-21.3	-40.8
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.6	-16.9	-35.3
Line of Sight	O	300 YDS	-1.5	3.0	3.8	0.0	-9.4	-25.9
Velocity. FPS			3300	2980	2683	2405	2143	1899
Energy. Ft-Lb Per Grain			24.18	19.72	15.98	12.84	10.20	8.01
Time of Flight, Seconds			0.0000	0.0957	0.2018	0.3199	0.4520	0.6008
Bullet Path	Z	100 YDS	-1.5	0.0	-2.4	-9.7	-23.0	-43.9
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-6.1	-18.2	-37.9
Line of Sight	O	300 YDS	-1.5	3.2	4.0	0.0	-10.1	-27.8
Velocity, FPS			3200	2888	2597	2324	2067	1828
Energy, Ft-Lb Per Grain			22.73	18.52	14.97	11.99	9.49	7.42
Time of Flight, Seconds			0.0000	0.0987	0.2083	0.3304	0.4673	0.6217
Bullet Path	Z	100 YDS	-1.5	0.0	-2.7	-10.5	-24.9	-47.4
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.5	-19.5	-40.7
Line of Sight	O	300 YDS	-1.5	3.5	4.3	0.0	-10.8	-29.8
Velocity, FPS			3100	2795	2510	2242	1990	1757
Energy Ft-Lb Per Grain			21.33	17.34	13.99	11.16	8.79	6.85
Time of Flight, Seconds			0.0000	0.1019	0.2152	0.3417	0.4838	0.6442
Bullet Path	Z	100 YDS	-1.5	0.0	-3.0	-11.5	-26.9	-51.2
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-7.0	-21.0	-43.8
Line of Sight	O	300 YDS	-1.5	3.8	4.7	0.0	-11.6	-32.1
Velocity, FPS			3000	2702	2422	2159	1914	1687
Energy, Ft-Lb Per Grain			19.98	16.21	13.02	10.35	8.13	6.32
Time of Flight, Seconds			0.0000	0.1054	0.2227	0.3539	0.5015	0.6685
Bullet Path	Z	100 YDS	-1.5	0.0	-3.3	-12.5	-29.2	-55.5
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.6	-22.7	-47.3
Line of Sight	O	300 YDS	-1.5	4.2	5.1	0.0	-12.6	-34.7
Velocity, FPS			2900	2608	2334	2077	1837	1617
Energy, Ft-Lb Per Grain			18.67	15.10	12.09	9.58	7.49	5.80
Time of Flight, Seconds			0.0000	0.1091	0.2307	0.3669	0.5205	0.6947
Bullet Path	Z	100 YDS	-1.5	0.0	-3.6	-13.7	-31.8	-60.3
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-8.2	-24.6	-51.2
Line of Sight	O	300 YDS	-1.5	4.6	5.5	0.0	-13.6	-37.5

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.32

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2800	2514	2246	1995	1761	1549
Energy, Ft-Lb Per Grain			17.41	14.03	11.20	8.84	6.88	5.33
Time of Flight, Seconds			0.0000	0.1131	0.2393	0.3811	0.5412	0.7229
Bullet Path	Z	100 YDS	-1.5	0.0	-4.0	-15.0	-34.7	-65.7
(Inches) +/-	E R	200 YDS	-1.5	2.0	0.0	-8.9	-26.7	-55.7
Line of Sight	O	300 YDS	-1.5	5.0	6.0	0.0	-14.7	-40.8
Velocity, FPS			2700	2421	2158	1912	1686	1482
Energy, Ft-Lb Per Grain			16.18	13.01	10.34	8.12	6.31	4.88
Time of Flight, Seconds			0.0000	0.1174	0.2486	0.3963	0.5635	0.7534
Bullet Path	Z	100 YDS	-1.5	0.0	-4.5	-16.4	-38 0	-71.8
(Inches) +/-	E R	200 YDS	-1.5	2.2	0.0	-9.7	-29.0	-60.6
Line of Sight	O	300 YDS	-1.5	5.5	6.5	0.0	-16.0	-44.4
Velocity, FPS			2600	2327	2070	1830	1611	1416
Energy, Ft-Lb Per Grain			15.01	12.02	9.51	7.43	5.76	4.45
Time of Flight, Seconds			0.0000	0.1220	0.2587	0.4129	0.5876	0.7864
Bullet Path	Z	100 YDS	-1.5	0.0	-5.0	-18.1	-41.6	-78.6
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-10.6	-31.7	-66.2
Line of Sight	O	300 YDS	-1.5	6.0	7.1	0.0	-17.5	-48.5
Velocity, FPS			2500	2233	1982	1749	1538	1353
Energy, Ft-Lb Per Grain			13.88	11.07	8.72	6.79	5.25	4.06
Time of Flight, Seconds			0.0000	0.1270	0.2696	0.4308	0.6138	0.8219
Bullet Path	Z	100 YDS	-1.5	0.0	-5.5	-19.9	-45.8	-86.4
(Inches) +/-	E R	200 YDS	-1.5	2.8	0.0	-11.7	-34.7	-72.6
Line of Sight	O	300 YDS	-1.5	6.6	7.8	0.0	-19.2	-53.2

Exterior Ballistic Table for Ballistic Coefficient 0.33

Velocity, FPS			3400	3082	2787	2511	2251	2006
Energy, Ft-Lb Per Grain			25.66	21.09	17.24	14.00	11.25	8.93
Time of Flight, Seconds			0.0000	0.0927	0.1951	0.3085	0.4347	0.5758
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-8.8	-21.0	-40.1
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.6	-16.7	-34.7
Line of Sight	O	300 YDS	-1.5	2.9	3.7	0.0	-9.3	-25.4
Velocity, FPS			3300	2990	2701	2430	2174	1935
Energy, Ft-Lb Per Grain			24.18	19.85	16.20	13.11	10.49	8.31
Time of Flight, Seconds			0.0000	0.0955	0.2011	0.3182	0.4488	0.5951
Bullet Path	Z	100 YDS	-1.5	0.0	-2.4	-9.6	-22.7	-43.2
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-6.0	-17.9	-37.2
Line of Sight	O	300 YDS	-1.5	3.2	4.0	0.0	-9.9	-27.2
Velocity, FPS			3200	2897	2614	2348	2097	1863
Energy, Ft-Lb Per Grain			22.73	18.63	15.17	12.24	9.76	7.71
Time of Flight, Seconds			0.0000	0.0986	0.2076	0.3287	0.4639	0.6157
Bullet Path	Z	100 YDS	-1.5	0.0	-2.7	-10.4	-24.5	-46.6
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.4	-19.2	-39.9
Line of Sight	O	300 YDS	-1.5	3.5	4.3	0.0	-10.6	-29.2

Exterior Ballistic Table for Ballistic Coefficient 0.33

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3100	2804	2526	2265	2020	1791
Energy, Ft-Lb Per Grain			21.33	17.46	14.17	11.39	9.06	7.12
Time of Flight, Seconds			0.0000	0.1018	0.2145	0.3399	0.4802	0.6379
Bullet Path	Z	100 YDS	-1.5	0.0	-2.9	-11.3	-26.6	-50.3
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-6.9	-20.7	-43.0
Line of Sight	O	300 YDS	-1.5	3.8	4.6	0.0	-11.4	-31.4
Velocity, FPS			3000	2710	2439	2183	1942	1720
Energy, Ft-Lb Per Grain			19.98	16.30	13.21	10.58	8.37	6.57
Time of Flight, Seconds			0.0000	0.1052	0.2219	0.3520	0.4977	0.6619
Bullet Path	Z	100 YDS	-1.5	0.0	-3.3	-12.4	-28.8	-54.5
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.5	-22.3	-46.4
Line of Sight	O	300 YDS	-1.5	4.1	5.0	0.0	-12.3	-33.9
Velocity, FPS			2900	2617	2350	2100	1865	1649
Energy, Ft-Lb Per Grain			18.67	15.20	12.26	9.79	7.72	6.04
Time of Flight, Seconds			0.0000	0.1089	0.2299	0.3649	0.5166	0.6877
Bullet Path	Z	100 YDS	-1.5	0.0	-3.6	-13.5	-31.4	-59.2
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-8.1	-24.2	-50.3
Line of Sight	O	300 YDS	-1.5	4.5	5.4	0.0	-13.3	-36.7
Velocity, FPS			2800	2523	2262	2017	1788	1579
Energy, Ft-Lb Per Grain			17.41	14.13	11.36	9.03	7.10	5.54
Time of Flight, Seconds			0.0000	0.1129	0.2385	0.3789	0.5370	0.7155
Bullet Path	Z	100 YDS	-1.5	0.0.	-4.0	-14.8	-34.2	-64.5
(Inches) +/-	E R	200 YDS	-1.5	2.0	0.0	-8.8	-26.2	-54.6
Line of Sight	O	300 YDS	-1.5	4.9	5.9	0.0	-14.5	-39.9
Velocity, FPS			2700	2429	2173	1934	1712	1511
Energy, Ft-Lb Per Grain			16.18	13.10	10.48	8.30	6.51	5.07
Time of Flight, Seconds			0.0000	0.1172	0.2477	0.3941	0.5590	0.7456
Bullet Path	Z	100 YDS	-1.5	0.0	-4.4	-16.2	-37.4	-70.5
(Inches) +/-	E R	200 YDS	-1.5	2.2	0.0	-9.6	-28.6	-59.4
Line of Sight	O	300 YDS	-1.5	5.4	6.4	0.0	-15.7	-43.4
Velocity. FPS			2600	2335	2085	1851	1637	1444
Energy, Ft-Lb Per Grain			15.01	12.10	9.65	7.61	5.95	4.63
Time of Flight, Seconds			0.0000	0.1218	0.2578	0.4105	0.5829	0.7782
Bullet Path	Z	100 YDS	-1.5	0.0	-4.9	-17.9	-41.0	-77.2
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-10.5	-31.2	-64.9
Line of Sight	O	300 YDS	-1.5	6.0	7.0	0.0	-17.2	-47.4
Velocity. FPS			2500	2240	1997	1770	1563	1379
Energy, Ft-Lb Per Grain			13.88	11.14	8.85	6.96	5.42	4.2
Time of Flight, Seconds			0.0000	0.1268	0.2686	0.4283	0.6088	0.813
Bullet Path	Z	100 YDS	-1.5	0.0	-5.5	-19.7	-45.1	-84.8
(Inches) +/-	E R	200 YDS	-1.5	2.7	0.0	-11.5	-34.2	71.1
Line of Sight	O	300 YDS	-1.5	6.6	7.7	0.0	-18.8	-52.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.34

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3300	2999	2717	2453	2203	1969
Energy, Ft-Lb Per Grain			24.18	19.97	16.39	13.36	10.77	8.61
Time of Flight, Seconds			0.0000	0.0954	0.2005	0.3167	0.4458	0.5898
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.4	-9.5	-22.4	-42.5
(Inches) +/-		200 YDS	-1.5	1.2	0.0	-5.9	-17.6	-36.5
Line of Sight		300 YDS	-1.5	3.2	3.9	0.0	-9.7	-26.7
Velocity, FPS			3200	2906	2630	2371	2126	1896
Energy, Ft-Lb Per Grain			22.73	18.75	15.36	12.48	10.03	7.98
Time of Flight, Seconds			0.0000	0.0984	0.2069	0.3271	0.4607	0.6102
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.6	-10.3	-24.2	-45.8
(Inches) +/-		200 YDS	-1.5	1.3	0.0	-6.4	- 18.9	-39.2
Line of Sight		300 YDS	-1.5	3.4	4.2	0.0	-10.5	-28.6
Velocity, FPS			3100	2812	2542	2288	2048	1824
Energy, Ft-Lb Per Grain			21.33	17.55	14.35	11.62	9.31	7.39
Time of Flight, Seconds			0.0000	0.1016	0.2138	0.3382	0.4768	0.6321
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.9	-11.2	-26.2	-49.5
(Inches) +/-		200 YDS	-1.5	1.5	0.0	-6.9	-20.4	-42.2
Line of Sight		300 YDS	-1.5	3.7	4.6	0.0	-11.2	-30.8
Velocity, FPS			3000	2719	2454	2205	1970	1751
Energy, Ft-Lb Per Grain			19.98	16.41	13.37	10.79	8.62	6.81
Time of Flight, Seconds			0.0000	0.1051	0.2212	0.3502	0.4942	0.6557
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.2	-12.2	-28.4	-53.6
(Inches) +/-		200 YDS	-1.5	1.6	0.0	-7.4	-22.0	-45.6
Line of Sight		300 YDS	-1.5	4.1	4.9	0.0	-12.1	-33.2
Velocity, FPS			2900	2625	2366	2121	1892	1680
Energy, Ft-Lb Per Grain			18.67	15.30	12.43	9.99	7.95	6.27
Time of Flight, Seconds			0.0000	0.1087	0.2291	0.3631	0.5129	0.6812
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.6	-13.4	-30.9	-58.3
(Inches) +/-		200 YDS	-1.5	1.8	0.0	-8.0	-23.8	-49.3
Line of Sight		300 YDS	-1.5	4.5	5.3	0.0	-13.1	-36.0
Velocity, FPS			2800	2531	2277	2038	1814	1609
Energy, Ft-Lb Per Grain			17.41	14.22	11.51	9.22	7.31	5.75
Time of Flight, Seconds			0.0000	0.1127	0.2377	0.3770	0.5330	0.7087
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.9	-14.6	-33.7	-63.4
(Inches) +/-		200 YDS	-1.5	2.0	0.0	-8.7	-25.8	-53.6
Line of Sight		300 YDS	-1.5	4.9	5.8	0.0	-14.2	-39.1
Velocity, FPS			2700	2437	2188	1954	1737	1539
Energy, Ft-Lb Per Grain			16.18	13.18	10.63	8.48	6.70	5.26
Time of Flight, Seconds			0.0000	0.1170	0.2469	0.3920	0.5549	0.7384
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.4	-16.1	-36.9	-69.3
(Inches) +/-		200 YDS	-1.5	2.2	0.0	-9.5	-28.1	-58.3
Line of Sight		300 YDS	-1.5	5.4	6.3	0.0	-15.5	-42.5

Exterior Ballistic Table for Ballistic Coefficient 0.34

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2600	2342	2099	1871	1661	1471
Energy, Ft-Lb Per Grain		15.01	12.18	9.78	7.77	6.12	4.80
Time of Flight, Seconds		0.0000	0.1216	0.2569	0.4083	0.5785	0.7706
Bullet Path	Z 100 YDS	-1.5	0.0	-4.9	-17.7	-40.4	-75.9
(Inches) +/-	E R 200 YDS	-1.5	2.4	0.0	-10.4	-30.7	-63.7
Line of Sight	O 300 YDS	-1.5	5.9	6.9	0.0	-16.9	-46.4
Velocity, FPS		2500	2248	2010	1789	1586	1404
Energy, Ft-Lb Per Grain		13.88	11.22	8.97	7.11	5.58	4.38
Time of Flight, Seconds		0.0000	0.1266	0.2677	0.4259	0.6041	0.8053
Bullet Path	Z 100 YDS	-1.5	0.0	-5.4	-19.5	-44.4	-83.3
(Inches) +/-	E R 200 YDS	-1.5	2.7	0.0	-11.3	-33.6	-69.8
Line of Sight	O 300 YDS	-1.5	6.5	7.6	0.0	-18.5	-50.9

Exterior Ballistic Table for Ballistic Coefficient 0.35

Velocity, FPS		3200	2914	2645	2392	2153	1928
Energy, Ft-Lb Per Grain		22.73	18.85	15.53	12.70	10.29	8.25
Time of Flight, Seconds		0.0000	0.0983	0.2063	0.3256	0.4578	0.6051
Bullet Path	Z 100 YDS	-1.5	0.0	-2.6	-10.2	-23.9	-45.1
(Inches) +/-	E R 200 YDS	-1.5	1.3	0.0	-6.3	-18.7	-38.6
Line of Sight	O 300 YDS	-1.5	3.4	4.2	0.0	-10.3	-28.1
Velocity, FPS		3100	2820	2557	2309	2075	1855
Energy, Ft-Lb Per Grain		21.33	17.65	14.52	11 84	9.56	7.64
Time of Flight, Seconds		0.0000	0.1015	0.2132	0.3367	0.4737	0.6267
Bullet Path	Z 100 YDS	-1.5	0.0	-2.9	-11.1	-25.9	-48.8
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-6.8	-20.1	-41.5
Line of Sight	O 300 YDS	-1.5	3.7	4.5	0.0	-11.1	-30.2
Velocity, FPS		3000	2726	2469	2225	1996	1781
Energy, Ft-Lb Per Grain		19.98	16.50	13.53	10.99	8.84	7.04
Time of Flight, Seconds		0.0000	0.1049	0.2205	0.3485	0.4909	0.6500
Bullet Path	Z 100 YDS	-1.5	0.0	-3.2	-12.1	-28.1	-52.8
(Inches) +/-	E R 200 YDS	-1.5	1.6	0.0	-7.3	-21.7	-44.8
Line of Sight	O 300 YDS	-1.5	4.0	4.9	0.0	-11.9	-32.6
Velocity, FPS		2900	2632	2380	2142	1917	1709
Energy, Ft-Lb Per Grain		18.67	15.38	12.58	10.19	8.16	6.48
Time of Flight, Seconds		0.0000	0.1086	0.2284	0.3613	0.5094	0.6752
Bullet Path	Z 100 YDS	-1.5	0.0	-3.5	-13.2	-30.5	-57.3
(Inches) +/-	E R 200 YDS	-1.5	1.8	0.0	-7.9	-23.5	-48.5
Line of Sight	O 300 YDS	-1.5	4.4	5.3	0.0	-12.9	-35.3
Velocity, FPS		2800	2538	2291	2058	1839	1637
Energy, Ft-Lb Per Grain		17.41	14.30	11.65	9.40	7.51	5.95
Time of Flight, Seconds		0.0000	0.1125	0.2370	0.3751	0.5294	0.7024
Bullet Path	Z 100 YDS	-1.5	0.0	-3.9	-14 5	-33.3	-62.4
(Inches) +/-	E R 200 YDS	-1.5	2.0	0.0	-8.6	-25.5	-52.6
Line of Sight	O 300 YDS	-1.5	4.8	5.7	0.0	-14.0	-38.3

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.35

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2700	2444	2202	1974	1761	1566
Energy, Ft-Lb Per Grain			16.18	13.26	10.76	8.65	6.88	5.44
Time of Flight, Seconds			0.0000	0.1168	0.2461	0.3900	0.5510	0.7317
Bullet Path	Z	100 YDS	-1.5	0.0	-4.3	-15.9	-36.4	-68.2
(Inches) +/-	E R	200 YDS	-1.5	2.2	0.0	-9.4	-27.7	-57.3
Line of Sight	O	300 YDS	-1.5	5.3	6.2	0.0	-15.2	-41.7
Velocity, FPS			2600	2349	2113	1890	1684	1497
Energy, Ft-Lb Per Grain			15.01	12.25	9.91	7.93	6.30	4.98
Time of Flight, Seconds			0.0000	0.1214	0.2561	0.4062	0.5744	0.7635
Bullet Path	Z	100 YDS	-1.5	0.0	-4.8	-17.5	-39.9	-74.6
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-10.2	-30.2	-42.6
Line of Sight	O	300 YDS	-1.5	5.8	6.8	0.0	-16.6	-45.5
Velocity, FPS			2500	2255	2024	1807	1608	1429
Energy, Ft-Lb Per Grain			13.88	11.29	9.09	7.25	5.74	4.53
Time of Flight, Seconds			0.0000	0.1264	0.2668	0.4237	0.5998	0.7978
Bullet Path	Z	100 YDS	-1.5	0.0	-5.4	-19.3	-43.8	-81.9
(Inches) +/-	E R	200 YDS	-1.5	2.7	0.0	-11.2	-33.1	-68.5
Line of Sight	O	300 YDS	-1.5	6.4	7.5	0.0	-18.2	-49.8
Velocity, FPS			2400	2160	1935	1725	1534	1364
Energy, Ft-Lb Per Grain			12.79	10.36	8.31	6.61	5.22	4.13
Time of Flight, Seconds			0.0000	0.1318	0.2785	0.4428	0.6273	0.8349
Bullet Path	Z	100 YDS	-1.5	0.0	-6.0	-21.3	-48.3	-90.2
(Inches) +/-	E R	200 YDS	-1.5	3.0	0.0	-12.3	-36.4	-75.3
Line of Sight	O	300 YDS	-1.5	7.1	8.2	0.0	-19.9	-54.7
Velocity, FPS			2300	2066	1847	1644	1461	1301
Energy, Ft-Lb Per Grain			11.74	9.48	7.57	6.00	4.74	3.76
Time of Flight, Seconds			0.0000	0.1376	0.2912	0.4635	0.6571	0.8750
Bullet Path	Z	100 YDS	-1.5	0.0	-6.7	-23.6	-53.4	-99.6
(Inches) +/-	E R	200 YDS	-1.5	3.3	0.0	-13.6	-40.1	-82.9
Line of Sight	O	300 YDS	-1.5	7.9	9.1	0.0	-22.0	-40.3
Velocity, FPS			2200	1972	1759	1565	1391	1243
Energy, Ft-Lb Per Grain			10.75	8.63	6.87	5.44	4.30	3.43
Time of Flight, Seconds			0.0000	0.1440	0.3051	0.4860	0.6896	0.9181
Bullet Path	Z	100 YDS	-1.5	0.0	-7.5	-26.2	-59.3	-110.3
(Inches) +/-	E R	200 YDS	-1.5	3.7	0.0	-15.0	-44.3	-91.6
Line of Sight	O	300 YDS	-1.5	8.7	10.0	0.0	-24.3	-66.6
Velocity, FPS			2100	1878	1673	1487	1323	1189
Energy, Ft-Lb Per Grain			9.79	7.83	6.21	4.91	3.89	3.14
Time of Flight, Seconds			0.0000	0.1511	0.3203	0.5107	0.7247	0.9644
Bullet Path	Z	100 YDS	-1.5	0.0	-8.4	-29.3	45.9	-122.5
(Inches) +/-	E R	200 YDS	-1.5	4.2	0.0	-16.7	-49.1	-101.5
Line of Sight	O	300 YDS	1.5	9.8	11.1	0.0	-26.9	-73.7

Exterior Ballistic Table for Ballistic Coefficient 0.36

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3700	3387	3096	2823	2568	2325
Energy, Ft-Lb Per Grain		30.39	25.47	21.28	17.69	14.64	12.00
Time of Flight, Seconds		0.0000	0.0848	0.1774	0.2789	0.3904	0.5132
Bullet Path	Z 100 YDS	-1.5	0.0	-1.5	-6.7	-16.3	-31.1
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-4.4	-13.2	-27.3
Line of Sight	O 300 YDS	-1.5	2.2	2.9	0.0	-7.3	-19.9
Velocity, FPS		3600	3294	3009	2742	2491	2253
Energy, Ft-Lb Per Grain		28.77	24.09	20.10	16.69	13.78	11.27
Time of Flight, Seconds		0.0000	0.0871	0.1824	0.2869	0.4017	0.5283
Bullet Path	Z 100 YDS	-1.5	0.0	-1.7	-7.3	-17.5	-33.3
(Inches) +/-	E R 200 YDS	-1.5	0.9	0.0	-4.7	-14.0	-29.0
Line of Sight	O 300 YDS	-1.5	2.4	3.1	0.0	-7.8	-21.2
Velocity, FPS		3500	3201	2922	2661	2414	2180
Energy, Ft-Lb Per Grain		27.20	22.75	18.96	15.72	12.94	10.55
Time of Flight, Seconds		0.0000	0.0896	0.1877	0.2953	0.4137	0.5445
Bullet Path	Z 100 YDS	-1.5	0.0	-1.9	-7.9	-18.8	-35.7
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-5.0	-15.0	-30.9
Line of Sight	O 300 YDS	-1.5	2.6	3.4	0.0	-8.3	-22.6
Velocity. FPS		3400	3108	2835	2579	2336	2106
Energy, Ft-Lb Per Grain		25.66	21.45	17.84	14.77	12.11	9.85
Time of Flight, Seconds		0.0000	0.0923	0.1934	0.3043	0.4266	0.5618
Bullet Path	Z 100 YDS	-1.5	0.0	-2.1	-8.6	-20.2	-38.3
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.4	-16.0	-33.1
Line of Sight	O 300 YDS	-1.5	2.9	3.6	0.0	-8.8	-24.1
Velocity, FPS		3300	3015	2748	2496	2258	2032
Energy, Ft-Lb Per Grain		24.18	20.18	16.76	13.83	11.32	9.17
Time of Flight, Seconds		0.0000	0.0951	0.1994	0.3139	0.4403	0.5804
Bullet Path	Z 100 YDS	-1.5	0.0	-2.3	-9.3	-21.8	-41.2
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-5.8	-17.2	-35.4
Line of Sight	O 300 YDS	-1.5	3.1	3.9	0.0	-9.5	-25.8
Velocity, FPS		3200	2921	2660	2413	2179	1958
Energy, Ft-Lb Per Grain		22.73	18.94	15.71	12.93	10.54	8.51
Time of Flight, Seconds		0.0000	0.0981	0.2058	0.3242	0.4550	0.6003
Bullet Path	Z 100 YDS	-1.5	0.0	-2.6	-10.1	-23.6	-44.5
(Inches) +/-	E R 200 YDS	-1.5	1.3	0.0	-6.2	-18.4	-38.0
Line of Sight	O 300 YDS	-1.5	3.4	4.1	0.0	-10.1	-27.6
Velocity, FPS		3100	2828	2571	2329	2100	1884
Energy, Ft-Lb Per Grain		21.33	17.76	14.67	12.04	9.79	7.88
Time of Flight, Seconds		0.0000	0.1013	0.2126	0.3352	0.4709	0.6217
Bullet Path	Z 100 YDS	-1.5	0.0	-2.9	-11.0	-25.6	-48.0
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-6.7	-19.8	-40.9
Line of Sight	O 300 YDS	-1.5	3.7	4.5	0.0	-10.9	-29.7

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.36

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3000	2734	2483	2245	2021	1810
Energy, Ft-Lb Per Grain			19.98	16.59	13.69	11.19	9.07	7.27
Time of Flight, Seconds			0.0000	0.1048	0.2199	0.3470	0.4879	0.6447
Bullet Path	Z	100 YDS	-1.5	0.0	-3.2	-12.0	-27.7	-52.0
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.2	-21.4	-44.1
Line of Sight	O	300 YDS	-1.5	4.0	4.8	0.0	-11.8	-32.1
Velocity, FPS			2900	2640	-2394	2161	1941	1737
Energy, Ft-Lb Per Grain			18.67	15.47	12.72	10.37	8.36	6.70
Time of Flight, Seconds			0.0000	0.1084	0.2278	0.3597	0.5062	0.6696
Bullet Path	Z	100 YDS	-1.5	0.0	-3.5	-13.1	-30.2	-56.5
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-7.8	-23.2	-47.7
Line of Sight	O	300 YDS	-1.5	4.4	5.2	0.0	-12.7	-34.7
Velocity, FPS			2800	2545	2304	2077	1862	1664
Energy, Ft-Lb Per Grain			17.41	14.38	11.79	9 58	7.70	6.15
Time of Flight, Seconds			0.0000	0.1124	0.2363	0.3734	0.526.0	0.6965
Bullet Path	Z	100 YDS	-1.5	0.0	-3.9	-14.3	-32.9	-61.5
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-8.5	-25.1	-51.8
Line of Sight	O	300 YDS	-1.5	4.8	5 7	0.0	-13.8	-37.6
Velocity, FPS			2700	2451	2215	1992	1784	1592
Energy, Ft-Lb Per Grain			16.18	13.34	10.89	8.81	7.07	5.63
Time of Flight, Seconds			0.0000	0.1166	0.2454	0.3882	0.5474	0.7255
Bullet Path	Z	100 YDS	-1.5	0.0	-4.3	-15.7	-35.9	-67.1
(Inches) +/-	E R	200 YDS	-1.5	2.2	0.0	-9.3	-27.3	-56.4
Line of Sight	O	300 YDS	-1.5	5.2	6.2	0.0	-15.0	-40.9
Velocity, FPS			2600	2356	2125	1908	1706	1521
Energy, Ft Lb Per Grain			15.01	12.32	10.02	8.08	6.46	5.14
Time of Flight, Seconds			0.0000	0.1212	0.2553	0.4043	0.5706	0.7569
Bullet Path	Z	100 YDS	-1.5	0.0	19.2	-17.3	-39.4	-73.5
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-10.1	-29.8	-61.5
Line of Sight	O	300 YDS	-1.5	5.8	6 7	0.0	-16.3	-44.7
Velocity, FPS			2500	2261	2036	1825	1629	1452
Energy, Ft-Lb Per Grain			13.88	11.35	9.20	7.39	5.89	4.68
Time of Flight, Seconds			0.0000	0.1262	0.2660	0.4217	0.5957	0.7909
Bullet Path	Z	100 YDS	-1.5	0.0	-5.3	-19.1	-43.3	-80.7
(Inches) +/-	E R	200 YDS	-1.5	2.7	0.0	-11.1	-32.7	-67.4
Line of Sight	O	300 YDS	-1.5	6.4	7.4	0.0	-17.9	-48.9

Exterior Ballistic Table for Ballistic Coefficient 0.37

Velocity, FPS			3500	3209	2937	2681	2440	2211
Energy, Ft-Lb Per Grain			27.20	22.86	19.15	15.96	13.22	10.85
Time of Flight, Seconds			0.0000	0.0895	0.1873	0.2942	0.4115	0.5407
Bullet Path	Z	100 YDS	-1.5	0.0	-1.9	-7.8	-18.6	-35.2
(Inches) +/-	E R	200 YDS	-1.5	0.9	0.0	-5.0	-14.8	-30.5
Line of Sight	O	300 YDS	-1.5	2.6	3.3	0.0	-8.2	-22.2

Exterior Ballistic Table for Ballistic Coefficient 0.37

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3400	3116	2850	2599	2361	2137
Energy, Ft-Lb Per Grain			25.66	21.56	18.03	15.00	12.38	10.14
Time of Flight, Seconds			0.0000	0.0922	0.1929	0.3031	0.4242	0.5578
Bullet Path	Z	100 YDS	-1.5	0.0	-2.1	-8.5	-20.0	-37.8
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.3	-15.8	-32.6
Line of Sight	O	300 YDS	-1.5	2.8	3.6	0.0	-8.7	-23.7
Velocity, FPS			3300	3022	2762	2516	2283	2062
Energy, Ft-Lb Per Grain			24.18	20.27	16.94	14.05	11.57	9.44
Time of Flight, Seconds			0.0000	0.0950	0.1989	0.3127	0.4379	0.5762
Bullet Path	Z	100 YDS	-1.5	0.0	-2.3	-9.2	-21.6	-40.7
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-5.7	-17.0	-34.9
Line of Sight	O	300 YDS	-1.5	3.1	3.8	0.0	-9.3	-25.4
Velocity, FPS			3200	2929	2674	2432	2204	1987
Energy, Ft-Lb Per Grain			22.73	19.05	15.87	13.13	10.78	8.77
Time of Flight, Seconds			0.0000	0.0980	0.2052	0.3229	0.4525	0.5958
Bullet Path	Z	100 YDS	-1.5	0.0	-2.6	-10.0	-23.3	-43.9
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.2	-18.2	-37.5
Line of Sight	O	300 YDS	-1.5	3.3	4.1	0.0	-10.0	-27.2
Velocity, FPS			3100	2835	2585	2348	2124	1913
Energy, Ft-Lb Per Grain			21.33	17.84	14.83	12.24	10.02	8.12
Time of Flight, Seconds			0.0000	0.1012	0.2120	0.3338	0.4681	0.6170
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-10.9	-25.3	-47.4
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.6	-19.6	-40.3
Line of Sight	O	300 YDS	-1.5	3.6	4.4	0.0	-10.8	-29.2
Velocity, FPS			3000	2741	2496	2264	2044	1838
Energy, Ft-Lb Per Grain			19.98	16.68	13.83	11.38	9.28	7.50
Time of Flight, Seconds			0.0000	0.1046	0.2193	0.3455	0.4850	0.6398
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-11.9	-27.4	-51.3
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.2	-21.1	-43.5
Line of Sight	O	300 YDS	-1.5	4.0	4.8	0.0	-11.6	-31.5
Velocity, FPS			2900	2647	2407	2179	1965	1763
Energy, Ft-Lb Per Grain			18.67	15.56	12.86	10.54	8.57	6.90
Time of Flight, Seconds			0.0000	0.1083	0.2272	0.3582	0.5032	0.6644
Bullet Path	Z	100 YDS	-1.5	0.0	-3.5	-13.0	-29.8	-55.7
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.8	-22.9	-47.0
Line of Sight	O	300 YDS	-1.5	4.3	5.2	0.0	-12.5	-34.1
Velocity, FPS			2800	2552	2317	2095	1885	1690
Energy, Ft-Lb Per Grain			17.41	14.46	11.92	9.74	7.89	6.34
Time of Flight, Seconds			0.0000	0.1122	0.2356	0.3718	0.5228	0.6910
Bullet Path	Z	100 YDS	-1.5	0.0	-3.9	-14.2	-32.5	-60.6
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-8.4	-24.8	-51.0
Line of Sight	O	300 YDS	-1.5	4.7	5.6	0.0	-13.6	-37.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.37

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2700	2457	2227	2010	1806	1617
Energy, Ft-Lb Per Grain			16.18	13.40	11.01	8.97	7.24	5.80
Time of Flight, Seconds			0.0000	0.1165	0.2447	0.3865	0.5440	0.7197
Bullet Path	Z	100 YDS	-1.5	0.0	-4.3	-15.6	-35.5	-66.2
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-9.2	-27.0	-55.5
Line of Sight	O	300 YDS	-1.5	5.2	6.1	0.0	-14.8	-40.2
Velocity, FPS			2600	2363	2138	1925	1727	1545
Energy, Ft-Lb Per Grain			15.01	12.40	10.15	8.23	6.62	5.30
Time of Flight, Seconds			0.0000	0.1210	0.2546	0.4025	0.5670	0.7507
Bullet Path	Z	100 YDS	-1.5	0.0	-4.7	-17.1	-38.9	-72.5
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-10.0	-29.4	-60.6
Line of Sight	O	300 YDS	-1.5	5.7	6.7	0.0	-16.1	-43.9
Velocity, FPS			2500	2268	2048	1841	1649	1475
Energy, Ft-Lb Per Grain			13.88	11.42	9.31	7.52	6.04	4.83
Time of Flight, Seconds			0.0000	0.1260	0.2652	0.4197	0.5919	0.7844
Bullet Path	Z	100 YDS	-1.5	0.0	-5.3	-18.9	-42.8	-79.5
(Inches) +/-	E R	200 YDS	-1.5	2.6	0.0	-11.0	-32.2	-66.3
Line of Sight	O	300 YDS	-1.5	6.3	7.3	0.0	-17.6	-48.0
Velocity, FPS			2400	2173	1959	1758	1573	1407
Energy, Ft-Lb Per Grain			12.79	10.48	8.52	6.86	5.49	4.39
Time of Flight Seconds			0.0000	0.1314	0.2768	0.4385	0.6190	0.8207
Bullet Path	Z	100 YDS	-1.5	0.0	-5.9	-20.9	-47.2	-87.5
(Inches) +/-	E R	200 YDS	-1.5	2.9	0.0	-12.0	-35.4	-72.8
Line of Sight	O	300 YDS	-1.5	7.0	8.0	0.0	-19.3	-52.8
Velocity, FPS			2300	2078	1870	1676	1499	1342
Energy, Ft-Lb Per Grain			11.74	9.59	7.76	6.24	4.99	4.00
Time of Flight, Seconds			0.0000	0.1372	0.2894	0.4590	0.6484	0.8601
Bullet Path	Z	100 YDS	-1.5	0.0	-6.6	-23.1	-52.1	-96.7
(Inches) +/-	E R	200 YDS	-1.5	3.3	0.0	-13.3	-39.0	-80.2
Line of Sight	O	300 YDS	-1.5	7.7	8.9	0.0	-21.3	-58.1
Velocity, FPS			2200	1984	1782	1595	1426	1280
Energy, Ft-Lb Per Grain			10.75	8.74	7.05	5.65	4.51	3.64
Time of Flight, Seconds			0.0000	0.1436	0.3032	0.4812	0.6803	0.9026
Bullet Path	Z	100 YDS	-1.5	0.0	-7.4	-25.7	-57.8	-107.0
(Inches) +/-	E R	200 YDS	-1.5	3.7	0.0	-14.7	-43.1	-88.6
Line of Sight	O	300 YDS	-1.5	8.6	9.8	0.0	-23.5	-64.2
Velocity, FPS			2100	1890	1694	1516	1356	1222
Energy, Ft-Lb Per Grain			9.79	7.93	6.37	5.10	4.08	3.32
Time of Flight, Seconds			0.0000	0.1506	0.3183	0.5056	0.7150	0.9484
Bullet Path	Z	100 YDS	-1.5	0.0	-8.3	-28.7	-64.3	-118.9
(Inches) +/-	E R	200 YDS	-1.5	4.1	0.0	-16.3	-47.8	-98.2
Line of Sight	O	300 YDS	-1.5	9.6	10.9	0.0	-26.1	-71.1

Exterior Ballistic Table for Ballistic Coefficient 0.38

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3400	3123	2863	2618	2386	2165
Energy, Ft-Lb Per Grain			25.66	21.65	18.20	15.22	12.64	10.41
Time of Flight, Seconds			0.0000	0.0921	0.1924	0.3020	0.4220	0.5540
Bullet Path	Z	100 YDS	-1.5	0.0	-2.1	-8.4	-19.8	-37.3
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.3	-15.7	-32.2
Line of Sight	O	300 YDS	-1.5	2.8	3.5	0.0	-8.6	-23.4
Velocity, FPS			3300	3029	2775	2535	2307	2090
Energy, Ft-Lb Per Grain			24.18	20.37	17.10	14.27	11.82	9.70
Time of Flight, Seconds			0.0000	0.0949	0.1984	0.3115	0.4356	0.5722
Bullet Path	Z	100 YDS	-1.5	0.0	-2.3	-9.1	-21.4	-40.2
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.7	-16.8	-34.4
Line of Sight	O	300 YDS	-1.5	3.0	3.8	0.0	-9.2	-25.0
Velocity, FPS			3200	2936	2687	2451	2227	2015
Energy, Ft-Lb Per Grain			22.73	19.14	16.03	13.34	11.01	9.01
Time of Flight, Seconds			0.0000	0.0979	0.2047	0.3216	0.4501	0.5917
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-9.9	-23.1	-43.3
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.1	-18.0	-37.0
Line of Sight	O	300 YDS	-1.5	3.3	4.1	0.0	-9.9	-26.8
Velocity, FPS			3100	2842	2598	2367	2147	1940
Energy, Ft-Lb Per Grain			21.33	17.93	14.98	12.44	10.23	8.36
Time of Flight, Seconds			0.0000	0.1011	0.2115	0.3325	0.4656	0.6126
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-10.8	-25.0	-46.8
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.6	-19.4	-39.7
Line of Sight	O	300 YDS	-1.5	3.6	4.4	0.0	-10.6	-28.8
Velocity, FPS			3000	2747	2509	2282	2067	1864
Energy, Ft-Lb Per Grain			19.98	16.75	13.98	11.56	9.49	7.71
Time of Flight, Seconds			0.0000	0.1045	0.2188	0.3442	0.4823	0.6352
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-11.8	-27.1	-50.7
(Inches) +/-	E R	200 YDS	-1.5	1.6	0.0	-7.1	-20.9	-42.9
Line of Sight	O	300 YDS	-1.5	3.9	4.7	0.0	-11.4	-31.0
Velocity, FPS			2900	2653	2419	2197	1987	1789
Energy, Ft-Lb Per Grain			1867	15.63	12.99	10.72	8.77	7.11
Time of Flight, Seconds			0.0000	0.1082	0.2266	0.3567	0.5004	0.6595
Bullet Path	Z	100 YDS	-1.5	0.0	-3.5	-12.9	-29.5	-55.0
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.7	-22.6	-46.4
Line of Sight	O	300 YDS	-1.5	4.3	5.1	0.0	-12.4	-33.5
Velocity, FPS			2800	2558	2329	2112	1906	1714
Energy, Ft-Lb Per Grain			17.41	14.53	12.04	9.90	8.07	6.52
Time of Flight, Seconds			0.0000	0.1121	0.2350	0.3703	0.5198	0.6858
Bullet Path	Z	100 YDS	-1.5	0.0	-3.8	-14.1	-32.2	-59.9
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-8.3	-24.5	-50.3
Line of Sight	O	300 YDS	-1.5	4.7	5.6	0.0	-13.4	-36.4

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.38

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2700	2464	2239	2026	1826	1641
Energy, Ft-Lb Per Grain			16.18	13.48	11.13	9.11	7.40	5.98
Time of Flight. Seconds			0.0000	0.1163	0.2441	0.3849	0.5409	0.7142
Bullet Path	Z	100 YDS	-1.5	0.0	-4.2	-15.4	-35.2	-65.3
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-9.1	-26.7	-54.7
Line of Sight	O	300 YDS	-1.5	5.1	6.1	0.0	-14.6	-39.6
Velocity, FPS			2600	2369	2149	1942	1747	1568
Energy, Ft-Lb Per Grain			15.01	12.46	10.25	8.37	6.78	5.46
Time of Flight, Seconds			0.0000	0.1209	0.2539	0.4007	0.5637	0.7450
Bullet Path	Z	100 YDS	-1.5	0.0	-4.7	-17.0	-38.5	-71.5
(Inches) +/-	E R	200 YDS	-1.5	2.4	0.0	-9.9	-29.1	-59.7
Line of Sight	O	300 YDS	-1.5	5.7	6.6	0.0	-15.9	-43.2
Velocity, FPS			2500	2274	2059	1857	1669	1497
Energy, Ft-Lb Per Grain			13.88	11.48	9.41	7.66	6.18	4.98
Time of Flight, Seconds			0.0000	0.1258	0.2645	0.4179	0.5884	0.7783
Bullet Path	Z	100 YDS	-1.5	0.0	-5.2	-18.7	-42.3	-78.4
(Inches) +/-	E R	200 YDS	-1.5	2.6	0.0	-10.9	-31.8	-65.3
Line of Sight	O	300 YDS	-1.5	6.2	7.2	0.0	-17.4	-47.2
Velocity, FPS			2400	2179	1970	1773	1592	1428
Energy, Ft-Lb Per Grain			12.79	10.54	8.62	6.98	5.63	4.53
Time of Flight, Seconds			0.0000	0.1312	0.2760	0.4366	0.6152	0.8143
Bullet Path	Z	100 YDS	-1.5	0.0	-5.8	-20.7	-46.6	-86.4
(Inches) +/-	E R	200 YDS	-1.5	2.9	0.0	-11.9	-34.9	-71.7
Line of Sight	O	300 YDS	-1.5	6.9	7.9	0.0	-19.0	-51.9
Velocity, FPS			2300	2084	1880	1690	1517	1361
Energy, Ft-Lb Per Grain			11.74	9.64	785	6.34	5.11	4.11
Time of Flight, Seconds			0.0000	0.1370	0 2886	0.4569	0.6444	0.8533
Bullet Path	Z	100 YDS	-1.5	0.0	-6.5	-22.9	-51.6	-95.3
(Inches) +/-	E R	200 YDS	-1.5	3.3	0.0	-13.1	-38.5	-79.0
Line of Sight	O	300 YDS	-1.5	7.6	8.8	0.0	-21.0	-57.1
Velocity, FPS			2200	1990	1792	1609	1443	1298
Energy, Ft-Lb Per Grain			10.75	8.79	7.13	5.75	4.62	3.74
Time of Flight, Seconds			0.0000	0.1434	0.3023	0.4791	0.6760	0.8955
Bullet Path	Z	100 YDS	-1.5	0.0	-7.3	-25.5	-57.2	-105.6
(Inches) +/-	E R	200 YDS	-1.5	3.7	0.0	-14.5	-42.5	-87.3
Line of Sight	O	300 YDS	-1.5	8.5	9.7	0.0	-23.2	-63.1
Velocity, FPS			2100	1895	1704	1529	1372	1238
Energy, Ft-Lb Per Grain			9.79	7.97	6.45	5.19	4.18	3.40
Time of Flight, Seconds			0.0000	0.1504	0.3173	0.5033	0.7105	0.9410
Bullet Path	Z	100 YDS	-1.5	0.0	-8 2	-28.4	-63.6	-117.3
(Inches) +/-	E R	200 YDS	-1.5	4.1	0.0	-16.1	-47.2	-96.7
Line of Sight	O	300 YDS	-1.5	9.5	10.7	0.0	-25.7	-69.9

Exterior Ballistic Table for Ballistic Coefficient 0.38

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	4 00 YDS	500 YDS
Velocity, FPS			2000	1802	1618	1451	1304	1183
Energy, Ft-Lb Per Grain			8.88	7.21	5.81	4.67	3.78	3.11
Time of Flight, Seconds			0.0000	0.1581	0.3338	0.5297	0.7480	0.9899
Bullet Path	Z	100 YDS	-1.5	0.0	-9.3	-31.8	-71.0	-130.6
(Inches) +/-	E R	200 YDS	-1.5	4.6	0.0	-18.0	-52.5	-107.5
Line of Sight	O	300 YDS	-1.5	10.6	12.0	0.0	-28.5	-77.5

Exterior Ballistic Table for Ballistic Coefficient 0.39

Velocity, FPS			3400	3130	2876	2637	2409	2193
Energy, Ft-Lb Per Grain			25.66	21.75	18.36	15.44	12.88	10.68
Time of Flight, Seconds			0.0000	0.0920	0.1920	0.3009	0.4200	0.5505
Bullet Path	Z	100 YDS	-1.5	0.0	-2.1	-8.3	-19.6	-36.9
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.2	-15.5	-31.8
Line of Sight	O	300 YDS	-1.5	2.8	3.5	0.0	-8.5	-23.0

Velocity, FPS			3300	3036	2788	2553	2330	2117
Energy, Ft-Lb Per Grain			24.18	20.46	17.26	14.47	12.05	9.95
Time of Flight, Seconds			0.0000	0.0948	0.1979	0.3104	0.4334	0.5685
Bullet Path	Z	100 YDS	-1.5	0.0	-2.3	-9.0	-21.2	-39.7
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.6	-16.6	-34 0
Line of Sight	O	300 YDS	-1.5	3.0	3.7	0.0	-9.1	-24.6

Velocity, FPS			3200	2942	2699	2469	2249	2042
Energy, Ft-Lb Per Grain			22.73	19.22	16.17	13.53	11.23	9.26
Time of Flight, Seconds			0.0000	0.0978	0.2043	0.3205	0.4478	0.5878
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-9.8	-22.9	-42 8
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.0	-17.8	-36.5
Line of Sight	O	300 YDS	-1.5	3.3	4.0	0.0	-9.8	-26.4

Velocity, FPS			3100	2848	2610	2384	2169	1966
Energy, Ft-Lb Per Grain			21.33	18.01	15.12	12.62	10.44	8.58
Time of Flight, Seconds			0.0000	0.1010	0.2110	0.3313	0.4632	0.6085
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-10.7	-24.8	-46.2
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.5	-19.2	-39.2
Line of Sight	O	300 YDS	-1.5	3.6	4.3	0.0	-10.5	-28.4

Velocity, FPS			3000	2754	2520	2299	2088	1889
Energy, Ft-Lb Per Grain			19.98	16.84	14.10	11.73	9.68	7.92
Time of Flight, Seconds			0.0000	0.1044	0.2183	0.3429	0.4798	0.6309
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-11.7	-26.9	-50.0
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-7.0	-20.7	-42.3
Line of Sight	O	300 YDS	-1.5	3.9	4.7	0.0	-11.3	-30.6

Velocity, FPS			2900	2659	2431	2213	2008	1814
Energy, Ft-Lb Per Grain			18.67	15.70	13.12	10 87	8.95	7.31
Time of Flight, Seconds			0.0000	0.1080	0.2260	0.3554	0.4977	0.6550
Bullet Path	Z	100 YDS	-1.5	0.0	-3.4	-12.8	-29.2	-54 3
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.6	-22.4	-45.7
Line of Sight	O	300 YDS	-1.5	4.3	5.1	0.0	-12.2	-33.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2800	2564	2341	2128	1927	1738
Energy, Ft-Lb Per Grain			17.41	14.59	12.17	10.05	8.24	6.71
Time of Flight, Seconds			0.0000	0.1120	0.2344	0.3688	0.5170	0.6810
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.8	-14.0	-31.8	-59.1
(Inches) +/-		200 YDS	-1.5	1.9	0.0	-8.3	-24.2	-49.6
Line of Sight		300 YDS	-1.5	4.7	5.5	0.0	-13.2	-35.8
Velocity, FPS			2700	2469	2250	2042	1846	1664
Energy, Ft-Lb Per Grain			16.18	13.53	11.24	9.26	7.57	6.15
Time of Flight, Seconds			0.0000	0.1162	0.2435	0.3834	0.5379	0.7091
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.2	-15.3	-34.8	-64.5
(Inches) +/-		200 YDS	-1.5	2.1	0.0	-9.0	-26.4	-53.9
Line of Sight		300 YDS	-1.5	5.1	6.0	0.0	-14.4	-39.0
Velocity, FPS			2600	2374	2160	1957	1766	1590
Energy, Ft-Lb Per Grain			15.01	12.51	10.36	8.50	6.92	5.61
Time of Flight, Seconds			0.0000	0.1207	0.2532	0.3991	0.5605	0.7396
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.7	-16.8	-38.1	-70.6
(Inches) +/-		200 YDS	-1.5	2.3	0.0	-9.8	-28.7	-58.9
Line of Sight		300 YDS	-1.5	5.6	6.5	0.0	-15.7	-42.5
Velocity, FPS			2500	2279	2070	1872	1687	1518
Energy, Ft-Lb Per Grain			13.88	11.53	9.51	7.78	6.32	5.12
Time of Flight, Seconds			0.0000	0.1257	0.2638	0.4162	0.5851	0.7726
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.2	-18.6	-41.9	-77.4
(Inches) +/-		200 YDS	-1.5	2.6	0.0	-10.7	-31.5	-64.4
Line of Sight		300 YDS	-1.5	6.2	7.2	0.0	-17.1	-46.5
Velocity, FPS			2400	2184	1980	1788	1610	1448
Energy, Ft-Lb Per Grain			12.79	10.59	8.70	7.10	5.75	4.65
Time of Flight, Seconds			0.0000	0.1310	0.2753	0.4348	0.6117	0.8083
Bullet Path	ZERO	100 YDS	-1.5	0.0	-5.8	-20.5	-46.1	-85.2
(Inches) +/-		200 YDS	-1.5	2.9	0.0	-11.8	-34.5	-70.7
Line of Sight		300 YDS	-1.5	6.8	7.9	0.0	-18.8	-51.0
Velocity, FPS			2300	2089	1890	1704	1534	1380
Energy, Ft-Lb Per Grain			11.74	9.69	7.93	6.45	5.22	4.23
Time of Flight, Seconds			0.0000	0.1369	0.2878	0.4550	0.6406	0.8470
Bullet Path	ZERO	100 YDS	-1.5	0.0	-6.5	-22.7	-51.0	-94.1
(Inches) +/-		200 YDS	-1.5	3.2	0.0	-13.0	-38.0	-77.9
Line of Sight		300 YDS	-1.5	7.6	8.7	0.0	-20.7	-56.2
Velocity, FPS			2200	1995	1802	1622	1459	1315
Energy, Ft-Lb Per Grain			10.75	8.84	7.21	5.84	4.73	3.84
Time of Flight, Seconds			0.0000	0.1432	0.3015	0.4770	0.6721	0.8889
Bullet Path	ZERO	100 YDS	-1.5	0.0	-7.3	-25.3	-56.6	-104.2
(Inches) +/-		200 YDS	-1.5	3.6	0.0	-14.4	-42.0	-86.0
Line of Sight		300 YDS	-1.5	8.4	9.6	0.0	-22.8	-62.1

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2100	1900	1714	1542	1387	1254
Energy Ft-Lb Per Grain		9.79	8.01	6.52	5.28	4.27	3.49
Time of Flight, Seconds		0.0000	0.1502	0.3165	0.5011	0.7063	0.9341
Bullet Path	Z 100 YDS	-1.5	0.0	-8.2	-28.2	-62.9	-115.7
(Inches) +/-	E R 200 YDS	-1 5	4.1	0.0	-16.0	-46.6	-95.3
Line of Sight	O 300 YDS	-1.5	9.4	10.6	0.0	-25.3	-68.7
Velocity, FPS		2000	1807	1627	1463	1318	1197
Energy, Ft-Lb Per Grain		8.88	7.25	5.88	4.75	3.86	3.18
Time of Flight, Seconds		0.0000	0.1578	0.3329	0.5274	0.7436	0.9828
Bullet Path	Z 100 YDS	-1.5	0.0	-9.2	-31.6	-70.2	-128.9
(Inches) +/-	E R 200 YDS	-1.5	4.6	0.0	-17.8	-51.8	-105.9
Line of Sight	O 300 YDS	-1.5	10.5	11.9	0.0	-28.1	-76.3
Velocity, FPS		1900	1713	1542	1387	1253	1145
Energy, Ft-Lb Per Grain		8.01	6.51	5.28	4.27	3.49	2.91
Time of Flight, Seconds		0.0000	0.1663	0.3510	0.5563	0.7841	1.0349
Bullet Path	Z 100 YDS	-1.5	0.0	-10 4	-35.4	-78.6	-144.0
(Inches) +/-	E R 200 YDS	-1.5	5.2	0.0	-19.9	-57.9	-118.0
Line of Sight	O 300 YDS	-1.5	11.8	13.2	0.0	-31.4	-84.9

Exterior Ballistic Table for Ballistic Coefficient 0.40

Velocity, FPS		3600	3323	3065	2821	2590	2370
Energy, Ft-Lb Per Grain		28.77	24.51	20.86	17.67	14.89	12.47
Time of Flight, Seconds		0.0000	0.0867	0.1808	0.2828	0.3938	0.5149
Bullet Path	Z 100 YDS	-1.5	0.0	-1.7	-7.0	-16.8	-31.7
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-4.5	-13.5	-27.6
Line of Sight	O 300 YDS	-1.5	2.3	3 0	0.0	-7.4	-20.0
Velocity, FPS		3500	3230	2977	2738	2511	2295
Energy, Ft-Lb Per Grain		27.20	23.16	19.68	16.64	14.00	11.69
Time of Flight, Seconds		0.0000	0.0892	0.1860	0.2911	0.4055	0.5305
Bullet Path	Z 100 YDS	-1.5	0.0	-1.8	-7.6	-18.0	-34.0
(Inches) +/-	E R 200 YDS	-1.5	0.9	0.0	-4 9	-14.4	-29.4
Line of Sight	O 300 YDS	-1.5	2.5	3.2	0.0	7.9	-21.3
Velocity, FPS		2300	2089	1890	1704	1534	1380
Energy, Ft-Lb Per Grain		11.74	9.69	7.93	6.45	5.22	4.23
Time of Flight, Seconds		0.0000	0.1369	0.2878	0.4550	0.6406	0.8470
Bullet Path	Z 100 YDS	-1.5	0.0	-6.5	-22.7	-51.0	-94.1
(Inches) +/-	E R 200 YDS	-1.5	3.2	0.0	-13.0	-38.0	-77.9
Line of Sight	O 300 YDS	-1.5	7.6	8.7	0.0	-20.7	-56.2
Velocity, FPS		2200	1995	1802	1622	1459	1315
Energy, Ft-Lb Per Grain		10.75	8.84	7.21	5.84	4.73	3.84
Time of Flight, Seconds		0.0000	0.1432	0.3015	0.4770	0.6721	0.8889
Bullet Path	Z 100 YDS	-1.5	0.0	-7.3	-25.3	-56.6	-104.2
(Inches) +/-	E R 200 YDS	-1.5	3 6	0.0	-14.4	-42.0	-86.0
Line of Sight	O 300 YDS	-1.5	8.4	9.6	0.0	-22.8	-62.1

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.39

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2100	1900	1714	1542	1387	1254
Energy Ft-Lb Per Grain		9.79	8.01	6.52	5.28	4.27	3.49
Time of Flight, Seconds		0.0000	0.1502	0.3165	0.5011	0.7063	0.9341
Bullet Path	Z 100 YDS	-1.5	0.0	-8.2	-28.2	-62.9	-115.7
(Inches) +/-	E R 200 YDS	-1.5	4.1	0.0	-16.0	-46.6	-95.3
Line of Sight	O 300 YDS	-1.5	9.4	10.6	0.0	-25.3	-68.7
Velocity, FPS		2000	1807	1627	1463	1318	1197
Energy, Ft-Lb Per Grain		8.88	7.25	5.88	4.75	3.86	3.18
Time of Flight, Seconds		0.0000	0.1578	0.3329	0.5274	0.7436	0.9828
Bullet Path	Z 100 YDS	-1.5	0.0	-9.2	-31.6	-70.2	-128.9
(Inches) +/-	E R 200 YDS	-1.5	4.6	0.0	-17.8	-51.8	-105.9
Line of Sight	O 300 YDS	-1.5	10.5	11.9	0.0	-28.1	-76.3
Velocity, FPS		1900	1713	1542	1387	1253	1145
Energy, Ft-Lb Per Grain		8.01	6.51	5.28	4.27	3.49	2.91
Time of Flight, Seconds		0.0000	0.1663	0.3510	0.5563	0.7841	1.0349
Bullet Path	Z 100 YDS	-1.5	0.0	-10.4	-35.4	-78.6	-144.0
(Inches) +/-	E R 200 YDS	-1.5	5.2	0.0	-19.9	-57.9	-118.0
Line of Sight	O 300 YDS	-1.5	11.8	13.2	0.0	-31.4	-84.9

Exterior Ballistic Table for Ballistic Coefficient 0.40

Velocity, FPS		3600	3323	3065	2821	2590	2370
Energy, Ft-Lb Per Grain		28.77	24.51	20.86	17.67	14.89	12.47
Time of Flight, Seconds		0.0000	0.0867	0.1808	0.2828	0.3938	0.5149
Bullet Path	Z 100 YDS	-1.5	0.0	-1.7	-7.0	-16.8	-31.7
(Inches) +/-	E R 200 YDS	-1.5	0.8	0.0	-4.5	-13.5	-27.6
Line of Sight	O 300 YDS	-1.5	2.3	3.0	0.0	-7.4	-20.0
Velocity, FPS		3500	3230	2977	2738	2511	2295
Energy, Ft-Lb Per Grain		27.20	23.16	19.68	16.64	14.00	11.69
Time of Flight, Seconds		0.0000	0.0892	0.1860	0.2911	0.4055	0.5305
Bullet Path	Z 100 YDS	-1.5	0.0	-1.8	-7.6	-18.0	-34.0
(Inches) +/-	E R 200 YDS	-1.5	0.9	0.0	-4 9	-14.4	-29.4
Line of Sight	O 300 YDS	-1.5	2.5	3.2	0.0	7.9	-21.3
Velocity, FPS		3400	3136	2888	2654	2431	2219
Energy, Ft-Lb Per Grain		25.66	21.83	18.52	15.64	13.12	10.93
Time of Flight, Seconds		0.0000	0.0919	0.1916	0.2999	0.4180	0.5472
Bullet Path	Z 100 YDS	-1.5	0.0	-2.0	-8.3	-19.4	-36.5
(Inches) +/-	E R 200 YDS	-1.5	1.0	0.0	-5.2	-15.3	-31.4
Line of Sight	O 300 YDS	-1.5	2.8	3.5	0.0	-8.4	-22.7
Velocity, FPS		3300	3042	2800	2570	2351	2143
Energy, Ft-Lb Per Grain		24.18	20.54	17.41	14.66	12.27	10.20
Time of Flight, Seconds		0.0000	0.0947	0.1975	0.3093	0.4314	0.5650
Bullet Path	Z 100 YDS	-1.5	0.0	-2.3	-9.0	-21.0	-39.3
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.6	-16.4	-33.6
Line of Sight	O 300 YDS	-1.5	3.0	3.7	0.0	-9.0	-24.3

SPEER LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.40

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3200	2948	2711	2485	2271	2067
Energy, Ft-Lb Per Grain			22.73	19.29	16.32	13.71	11.45	9.49
Time of Flight, Seconds			0.0000	0.0977	0.2038	0.3194	0.4457	0.5841
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-9.8	-22.7	-42.3
(Inches) +/-	E R	200 YDS	-1.5	1.3	0.0	-6.0	-17.6	-36.0
Line of Sight	O	300 YDS	-1.5	3.3	4.0	0.0	-9.6	-26.0
Velocity, FPS			3100	2854	2622	2400	2190	1990
Energy, Ft-Lb Per Grain			21.33	18.08	15 26	12.79	10.65	8.79
Time of Flight, Seconds			0.0000	0.1009	0.2105	0.3301	0.4610	0.6047
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-10.6	-24.5	-45.7
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.5	-19.0	-38.8
Line of Sight	O	300 YDS	-1.5	3.5	4.3	0.0	-10.4	-28.0
Velocity, FPS			3000	2760	2532	2315	2109	1914
Energy, Ft-Lb Per Grain			19.98	16.91	14.23	11.90	9.87	8.13
Time of Flight, Seconds			0.0000	0.1043	0.2178	0.3417	0.4775	0.6268
Bullet Path	Z	100 YDS	-1.5	0.0	-3.1	-11.6	-26.6	-49.5
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-7.0	-20.5	-41.8
Line of Sight	O	300 YDS	-1.5	3.9	4 7	0.0	-11.2	-30.2
Velocity, FPS			2900	2665	2442	2229	2028	1837
Energy, Ft-Lb Per Grain			18.67	15.77	13.24	11.03	9.13	7.49
Time of Flight, Seconds			0.0000	0.1079	0.2255	0.3541	0.4952	0.6507
Bullet Path	Z	100 YDS	-1.5	0.0	-3.4	-12.7	-28.9	-53.7
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.6	-22.1	-45.2
Line of Sight	O	300 YDS	-1.5	4.2	5.0	0.0	-12.0	-32.6
Velocity, FPS			2800	2570	2352	2143	1946	1761
Energy, Ft-Lb Per Grain			17.41	14.66	12.28	10.20	8.41	6.88
Time of Flight, Seconds			0.0000	0.1118	0.2339	0.3675	0.5144	0.6765
Bullet Path	Z	100 YDS	-1.5	0.0	-3.8	-13.9	-31.5	-58.4
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-8.2	-24.0	-49.0
Line of Sight	O	300 YDS	-1.5	4.6	5.5	0.0	-13.1	-35.3
Velocity, FPS			2700	2475	2261	2058	1865	1686
Energy. Ft-Lb Per Grain			16.18	13.60	11.35	9.40	7.72	6.31
Time of Flight, Seconds			0.0000	0.1161	0.2429	0.3820	0.5351	0.7043
Bullet Path	Z	100 YDS	-1.5	0.0	-4.2	-15.2	-34.5	-63.7
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-8.9	-26.1	-53.3
Line of Sight	O	300 YDS	-1.5	5.1	5.9	0.0	-14.2	-38.4
Velocity, FPS			2600	2380	2171	1972	1785	1611
Energy, Ft-Lb Per Grain			15.01	12 58	10.46	8.63	7.07	5.76
Time of Flight, Seconds			0.0000	0.1206	0.2526	0.3976	0.5576	0.7345
Bullet Path	Z	100 YDS	-1.5	0.0	-4.7	-16.7	-37.7	-69.7
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-9.7	-28.4	-58.1
Line of Sight	O	300 YDS	-1.5	5.6	6.5	0.0	-15.5	-49.1

Exterior Ballistic Table for Ballistic Coefficient 0.40

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2500	2285	2080	1886	1705	1538
Energy, Ft-Lb Per Grain			13.88	11.59	9.60	7.90	6.45	5.25
Time of Flight, Seconds			0.0000	0.1255	0.2632	0.4146	0.5819	0.7672
Bullet Path	Z	100 YDS	-1.5	0.0	-5.2	-18.4	-41.5	-76.5
(Inches) +/-	E R	200 YDS	-1.5	2.6	0.0	-10.7	-31.1	-63.6
Line of Sight	O	300 YDS	-1.5	6.1	7.1	0.0	-16.9	-45.8
Velocity, FPS			2400	2190	1990	1802	1627	1467
Energy, Ft-Lb Per Grain			12.79	10.65	8.79	7.21	5.88	4.78
Time of Flight, Seconds			0.0000	0.1309	0.2746	0.4331	0.6083	0.8026
Bullet Path	Z	100 YDS	-1.5	0.0	-5.8	-20.4	-45.7	-84.2
(Inches) +/-	E R	200 YDS	-1.5	2.9	0.0	-11.7	-34.1	-69.8
Line of Sight	O	300 YDS	-1.5	6.8	7.8	0.0	-18.5	-50.3
Velocity, FPS			2300	2095	1900	1718	1550	1398
Energy, Ft-Lb Per Grain			11.74	9.74	8.01	6.55	5.33	4.34
Time of Flight, Seconds			0.0000	0.1367	0.2871	0.4532	0.6371	0.8410
Bullet Path	Z	100 YDS	-1.5	0.0	-6.4	-22.6	-50.5	-92.9
(Inches) +/-	E R	200 YDS	-1.5	3.2	0.0	-12.9	-37.6	-76.8
Line of Sight	O	300 YDS	-1.5	7.5	8.6	0.0	-20.4	-55.3
Velocity, FPS			2200	2000	1811	1635	1475	1332
Energy, Ft-Lb Per Grain			10.75	8.88	7.28	5.93	4.83	3.94
Time of Flight, Seconds			0.0000	0.1430	0.3007	0.4751	0.6683	0.8826
Bullet Path	Z	100 YDS	-1.5	0.0	-7.2	-25.1	-56.0	-102.9
(Inches) +/-	E R	200 YDS	-1.5	3.6	0.0	-14.2	-41.5	-84 9
Line of Sight	O	300 YDS	-1.5	8.4	9.5	0.0	-22.5	-61.1

Exterior Ballistic Table for Ballistic Coefficient 0.41

Velocity, FPS			3300	3049	2811	2586	2372	2168
Energy, Ft-Lb Per Grain			24.18	20.64	17.54	14.85	12.49	10.43
Time of Flight, Seconds			0.0000	0.0946	0.1971	0.3083	0.4295	0.5618
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-8.9	-20.8	-38.8
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.5	-16.3	-33.2
Line of Sight	O	300 YDS	-1.5	3.0	3.7	0.0	-8.9	-24.0
Velocity, FPS			3200	2954	2722	2502	2291	2091
Energy, Ft-Lb Per Grain			22.73	19.37	16.45	13.90	11.65	9.71
Time of Flight, Seconds			0.0000	0.0976	0.2034	0.3183	0.4437	0.5807
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-9.7	-22.4	-41 8
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-5.9	-17.5	-35 6
Line of Sight	O	300 YDS	-1.5	3.2	4.0	0.0	-9.5	-25.7
Velocity, FPS			3100	2860	2633	2416	2210	2014
Energy, Ft-Lb Per Grain			21.33	18.16	15.39	12.96	10.84	9.01
Time of Flight, Seconds			0.0000	0.1008	0.2101	0.3291	0.4589	0.6011
Bullet Path	Z	100 YDS	-1.5	0.0	-2.8	-10.5	-24.3	-45.2
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.4	-18.8	-38 3
Line of Sight	O	300 YDS	-1.5	3.5	4.3	0.0	-10.2	-27.6

Exterior Ballistic Table for Ballistic Coefficient 0.41

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3000	2765	2543	2331	2129	1937
Energy, Ft-Lb Per Grain		19.98	16.97	14.36	12.06	10.06	8.33
Time of Flight, Seconds		0.0000	0.1042	0.2173	0.3405	0.4752	0.6230
Bullet Path	Z 100 YDS	-1.5	0.0	-3.1	-11.5	-26.4	-48.9
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-6.9	-20.3	-41.3
Line of Sight	O 300 YDS	-1.5	3.8	4.6	0.0	-11.0	-29.8
Velocity, FPS		2900	2671	2452	2245	2047	1860
Energy, Ft-Lb Per Grain		18.67	15.84	13.35	11.19	9.30	7.68
Time of Flight, Seconds		0.0000	0.1078	0.2250	0.3529	0.4929	0 6467
Bullet Path	Z 100 YDS	-1.5	0.0	-3.4	-12.6	-28.7	-53.1
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-7.5	-21.9	-44.6
Line of Sight	O 300 YDS	-1 5	4.2	5.0	0.0	-11.9	-32.1
Velocity, FPS		2800	2576	2362	2158	1965	1783
Energy, Ft-Lb Per Grain		17.41	14.73	12.39	10.34	8.57	7 06
Time of Flight, Seconds		0.0000	0.1117	0.2334	0.3662	0.5119	0.6722
Bullet Path	Z 100 YDS	-1.5	0.0	-3.8	-13.8	-31.2	-57.8
(Inches) +/-	E R 200 YDS	-1.5	1.9	0.0	-8.1	-23.7	-48.4
Line of Sight	O 300 YDS	-1.5	4.6	5.4	0.0	-12.9	-34.8
Velocity, FPS		2700	2480	2271	2072	1884	1707
Energy, Ft-Lb Per Grain		16.18	13.65	11.45	9.53	7.88	6.47
Time of Flight, Seconds		0.0000	0.1159	0.2423	0.3806	0.5325	0.6998
Bullet Path	Z 100 YDS	-1.5	0.0	-4.2	-15.1	-34 1	-63.0
(Inches) +/-	E R 200 YDS	-1.5	2.1	0.0	-8.8	-25.8	-52.6
Line of Sight	O 300 YDS	-1.5	5.0	5.9	0.0	-14.0	-37.9
Velocity, FPS		2600	2385	2180	1986	1803	1632
Energy, Ft-Lb Per Grain		15.01	12.63	10.55	8.76	7.22	5.91
Time of Flight, Seconds		0.0000	0.1205	0.2520	0.3962	0.5548	0.7298
Bullet Path	Z 100 YDS	-1.5	0.0	-4.6	-16.6	-37.4	-68.9
(Inches) +/-	E R 200 YDS	- 1.5	2.3	0.0	-9.6	-28.1	-57.4
Line of Sight	O 300 YDS	-1.5	5.5	6.4	0.0	-15.3	-41.3
Velocity, FPS		2500	2290	2090	1900	1722	1558
Energy, Ft-Lb Per Grain		13.88	11.64	9.70	8.01	6.58	5.39
Time of Flight, Seconds		0.0000	0.1254	0.2625	0.4131	0.5790	0.7622
Bullet Path	Z 100 YDS	-1.5	0.0	-5.1	-18.3	-41.1	-75.6
(Inches) +/-	E R 200 YDS	-1.5	2.6	0.0	-10.6	-30.8	-62.8
Line of Sight	O 300 YDS	-1.5	6.1	7.0	0.0	-16.7	-45.2
Velocity, FPS		2400	2195	1999	1815	1643	1486
Energy, Ft-Lb Per Grain		12.79	10.70	8.87	7.31	5.99	4.90
Time of Flight, Seconds		0.0000	0.1307	0.2740	0.4315	0.6052	0.7973
Bullet Path	Z 100 YDS	-1.5	0.0	-5.7	-20.2	-45.3	-83.2
(Inches) +/-	E R 200 YDS	-1.5	2.9	0.0	-11.6	-33.8	-68.9
Line of Sight	O 300 YDS	-1.5	6.7	7.7	0.0	-18.3	-49.5

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.41

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2300	2099	1909	1731	1566	1416
Energy, Ft-Lb Per Grain			11.74	9.78	8.09	6.65	5.44	4.45
Time of Flight, Seconds			0.0000	0.1365	0.2864	0.4514	0.6337	0.8354
Bullet Path	Z	100 YDS	-1.5	0.0	-6.4	-22.4	-50.0	-91.9
(Inches) +/-	E R	200 YDS	-1.5	3.2	0.0	-12.8	-37.2	-75.8
Line of Sight	O	300 YDS	-1.5	7.5	8.5	0.0	-20.2	-54.5
Velocity, FPS			2200	2004	1820	1648	1490	1348
Energy, Ft-Lb Per Grain			10.75	8.92	7.35	6.03	4.93	4.03
Time of Flight, Seconds			0.0000	0.1429	0.3000	0.4732	0.6648	0.8766
Bullet Path	Z	100 YDS	-1.5	0.0	-7.2	-24.9	-55.4	-101.7
(Inches) +/-	E R	200 YDS	-1.5	3.6	0.0	-14.1	-41.1	-63.8
Line of Sight	O	300 YDS	-1.5	8.3	9.4	0.0	-22.3	-60.2
Velocity, FPS			2100	1910	1731	1566	1416	1284
Energy, Ft-Lb Per Grain			9.79	8.10	6.65	5.44	4.45	3.66
Time of Flight, Seconds			0.0000	0.1498	0.3148	0.4971	0.6986	0.9213
Bullet Path	Z	100 YDS	-1.5	0.0	-8.1	-27.8	-61.7	-113.0
(Inches) +/-	E R	200 YDS	-1.5	4.0	0.0	-15.7	-45.5	-92.8
Line of Sight	O	300 YDS	-1.5	9.3	10.4	0.0	-24.7	-66.7
Velocity, FPS			2000	1816	1644	1486	1345	1224
Energy, Ft-Lb Per Grain			8.88	7.32	6.00	4.90	4.02	3.33
Time of Flight, Seconds			0.0000	0.1574	0.3311	0.5232	0.7355	0.9696
Bullet Path	Z	100 YDS	-1.5	0.0	-9.1	-31.1	-68.8	-125.9
(Inches) +/-	E R	200 YDS	-1.5	4.5	0.0	-17.4	-50.7	-103.2
Line of Sight	O	300 YDS	-1.5	10.4	11.6	0.0	-27.4	-74.1

Exterior Ballistic Table for Ballistic Coefficient 0.42

Velocity, FPS			3400	3148	2911	2687	2473	2269
Energy, Ft-Lb Per Grain			25.66	22.00	18.81	16.03	13.58	11.43
Time of Flight, Seconds			0.0000	0.0917	0.1908	0.2981	0.4145	0.5411
Bullet Path	Z	100 YDS	-1.5	0.0	-2.0	-8.1	-19.1	-35.7
(Inches) +/-	E R	200 YDS	-1.5	1.0	0.0	-5.1	-15.1	-30.7
Line of Sight	O	300 YDS	-1.5	2.7	3.4	0.0	-8.2	-22.2
Velocity, FPS			3300	3054	2822	2602	2392	2192
Energy, Ft-Lb Per Grain			24.18	20.71	17.68	15.03	12.70	10 67
Time of Flight, Seconds			0.0000	0.0945	0.1967	0.3074	0.4277	0.5587
Bullet Path	Z	100 YDS	-1.5	0.0	-2.2	-8.8	-20.6	-38.4
(Inches) +/-	E R	200 YDS	-1.5	1.1	0.0	-5.5	-16.1	-32.9
Line of Sight	O	300 YDS	-1.5	2.9	3.7	0 0	-8.8	-23.7
Velocity, FPS			3200	2960	2733	2517	2311	2115
Energy, Ft-Lb Per Grain			22.73	19.45	16.58	14.06	11.86	9.93
Time of Flight, Seconds			0.0000	0.0975	0.2030	0.3174	0.4418	0.5775
Bullet Path	Z	100 YDS	-1.5	0.0	-2.5	-9.6	-22.3	-41.4
(Inches) +/-	E R	200 YDS	-1.5	1.2	0.0	-5.9	-17.3	-35.2
Line of Sight	O	300 YDS	-1.5	3.2	3.9	0.0	-9.4	-25.4

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.42

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3100	2866	2643	2431	2229	2037
Energy, Ft-Lb Per Grain		21.33	18.24	15.51	13.12	11.03	9.21
Time of Flight, Seconds		0.0000	0.1007	0.2097	0.3280	0.4569	0.5977
Bullet Path	Z 100 YDS	-1.5	0.0	-2.7	-10.5	-24.1	-44.7
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-6.4	-18.6	-37.9
Line of Sight	O 300 YDS	-1.5	3.5	4.2	0.0	-10.1	-27.3
Velocity, FPS		3000	2771	2553	2345	2147	1959
Energy, Ft-Lb Per Grain		19.98	17.05	14.47	12.21	10.23	8.52
Time of Flight, Seconds		0.0000	0.1041	0.2169	0.3395	0.4731	0.6194
Bullet Path	Z 100 YDS	-1.5	0.0	-3.0	-11.4	-26.1	-48.4
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-6.9	-20.1	-40.8
Line of Sight	O 300 YDS	-1 5	3.8	4.6	0.0	-10.9	-29.4
Velocity, FPS		2900	2676	2463	2259	2065	1881
Energy, Ft-Lb Per Grain		18.67	15.90	13.47	11.33	9.47	7.85
Time of Flight, Seconds		0.0000	0.1077	0.2246	0.3518	0.4907	0.6429
Bullet Path	Z 100 YDS	-1.5	0.0	-3.4	-12.5	-28.4	-52.5
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-7.4	-21.7	-44.1
Line of Sight	O 300 YDS	-1.5	4.2	5.0	0.0	-11.8	-31.7
Velocity, FPS		2800	2581	2372	2173	1983	1804
Energy Ft-Lb Per Grain		17.41	14.79	12.49	10.48	8.73	7.23
Time of Flight, Seconds		0.0000	0.1116	0.2329	0.3650	0.5096	0.6682
Bullet Path	Z 100 YDS	-1.5	0.0	-3.7	-13.7	-31.0	-57.2
(Inches) +/-	E R 200 YDS	-1.5	1.9	0.0	-8.1	-23.5	-47.8
Line of Sight	O 300 YDS	-1.5	4.6	5.4	0.0	-12.8	-34.4
Velocity, FPS		2700	2486	2281	2086	1901	1727
Energy, Ft-Lb Per Grain		16.18	13.72	11.55	9.66	8.02	6.62
Time of Flight, Seconds		0.0000	0.1158	0.2418	0.3793	0.5300	0.6956
Bullet Path	Z 100 YDS	-1.5	0.0	-4.1	-15.0	-33.8	-62.3
(Inches) +/-	E R 200 YDS	-1.5	2.1	0.0	-8.8	-25.6	-52.0
Line of Sight	O 300 YDS	-1 5	5.0	5.8	0.0	-13.9	-37.4
Velocity, FPS		2600	2390	2190	2000	1820	1651
Energy, Ft-Lb Per Grain		15.01	12.68	10.65	8.88	7.35	6.05
Time of Flight, Seconds		0.0000	0.1203	0.2515	0.3948	0.5521	0.7253
Bullet Path	Z 100 YDS	-1.5	0.0	-4.6	-16.5	-37.1	-68.2
(Inches) +/-	E R 200 YDS	-1.5	2.3	0.0	-9.6	-27.9	-56.7
Line of Sight	O 300 YDS	-1.5	5.5	6.4	0.0	-15.1	-40.7
Velocity, FPS		2500	2295	2099	1913	1739	1577
Energy, Ft-Lb Per Grain		13.88	11.69	9.78	8.12	6.71	5.52
Time of Flight, Seconds		0.0000	0.1253	0.2620	0.4117	0.5762	0.7574
Bullet Path	Z 100 YDS	-1.5	0.0	-5.1	-18.2	-40.7	-74.8
(Inches) + /-	E R 200 YDS	-1.5	2.6	0.0	-10.5	-30.5	-62.0
Line of Sight	O 300 YDS	-1.5	6.1	7.0	0.0	-16.5	-44.5

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.42

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2400	2199	2008	1828	1659	1504
Energy, Ft-Lb Per Grain		12.79	10.74	8.95	7.42	6.11	5.02
Time of Flight, Seconds		0.0000	0.1306	0.2733	0.4299	0.6022	0.7923
Bullet Path	Z 100 YDS	-1.5	0.0	-5.7	-20.1	-44.8	-82.3
(Inches) +/-	E R 200 YDS	-1.5	2.9	0.0	-11.5	-33.4	-68.0
Line of Sight	O 300 YDS	-1.5	6.7	7.7	0.0	-18.1	-48.9
Velocity, FPS		2300	2104	1918	1743	1581	1433
Energy, Ft-Lb Per Grain		11.74	9.83	8.17	6.74	5.55	4.56
Time of Flight, Seconds		0.0000	0.1364	0.2857	0.4498	0.6306	0.8301
Bullet Path	Z 100 YDS	-1.5	0.0	-6.4	-22.2	-49.6	-90.8
(Inches) +/-	E R 200 YDS	-1.5	3.2	0.0	-12.7	-36.8	-74.9
Line of Sight	O 300 YDS	-1.5	7.4	8.4	0.0	-19.9	-53.8
Velocity, FPS		2200	2009	1828	1660	1504	1364
Energy, Ft-Lb Per Grain		10.75	8.96	7.42	6.12	5.02	4.13
Time of Flight, Seconds		0.0000	0.1427	0.2992	0.4715	0.6615	0.8710
Bullet Path	Z 100 YDS	-1.5	0.0	-7.1	-24.7	-54.9	-100.6
(Inches) +/-	E R 200 YDS	-1.5	3.6	0.0	-14.0	-40.7	-82.7
Line of Sight	O 300 YDS	-1.5	8.2	9.3	0.0	-22.0	-59.4
Velocity, FPS		2100	1914	1740	1577	1430	1299
Energy, Ft-Lb Per Grain		9.79	8.13	6.72	5.52	4.54	3.75
Time of Flight, Seconds		0.0000	0.1496	0.3141	0.4952	0.6951	0.9155
Bullet Path	Z 100 YDS	-1.5	0.0	-8.0	-27 6	-61.1	-111.7
(Inches) +/-	E R 200 YDS	-1.5	4.0	0.0	- 15.5	-45.1	-91.7
Line of Sight	O 300 YDS	-1.5	9.2	10.4	0.0	-24.4	-65.8
Velocity, FPS		2000	1820	1652	1497	1358	1237
Energy Ft-Lb Per Grain		8.88	7.35	6.06	4.98	4.09	3.40
Time of Flight, Seconds		0.0000	0.1573	0.3303	0.5212	0.7318	0.9635
Bullet Path	Z 100 YDS	-1.5	0.0	-9.0	-30.8	-68.2	-124.5
(Inches) +/-	E R 200 YDS	-1.5	4.5	0.0	-17.3	-50.1	-101.9
Line of Sight	O 300 YDS	-1.5	10.3	11.5	0.0	-27.1	-73.1

Exterior Ballistic Table for Ballistic Coefficient 0.43

Velocity, FPS		3300	3060	2833	2617	2411	2215
Energy, Ft-Lb Per Grain		24.18	20.79	17.82	15.20	12.91	10.89
Time of Flight, Seconds		0.0000	0.0944	0.1963	0.3065	0.4259	0.5558
Bullet Path	Z 100 YDS	-1.5	0.0	-2.2	-8.8	-20.4	-38.1
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.4	-16.0	-32.5
Line of Sight	O 300 YDS	-1.5	2.9	3.6	0.0	-8.7	-23.4
Velocity, FPS		3200	2965	2743	2532	2330	2137
Energy, Ft-Lb Per Grain		22.73	19.52	16.70	14.23	12.05	10.14
Time of Flight, Seconds		0.0000	0.0974	0.2026	0.3164	0.4400	0.5744
Bullet Path	Z 100 YDS	-1.5	0.0	-2.5	-9.5	-22.1	-41.0
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-5.9	-1.2	-34.9
Line of Sight	O 300 YDS	-1.5	3.2	3.9	0.0	-9.3	-25.1

Exterior Ballistic Table for Ballistic Coefficient 0.43

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3100	2871	2653	2446	2248	2059
Energy, Ft-Lb Per Grain			21.33	18.30	15.63	13.28	11.22	9.41
Time of Flight, Seconds			0.0000	0.1006	0.2093	0.3270	0.4550	0.5945
Bullet Path	Z	100 YDS	-1.5	0.0	-2.7	-10.4	-23.9	-44.3
(Inches) +/-	E R	200 YDS	-1.5	1.4	0.0	-6.3	-18.4	-37.5
Line of Sight	O	300 YDS	-1.5	3.5	4.2	0.0	-10.0	-27.0
Velocity, FPS			3000	2776	2563	2360	2165	1980
Energy, Ft-Lb Per Grain			19.98	17.11	14.58	12.36	10.41	8.70
Time of Flight, Seconds			0.0000	0.1040	0.2164	0.3384	0.4712	0.6160
Bullet Path	Z	100 YDS	-1.5	0.0	-3.0	-11.3	-25.9	-47.9
(Inches) +/-	E R	200 YDS	-1.5	1.5	0.0	-6.8	-19.9	-40.4
Line of Sight	O	300 YDS	-1.5	3.8	4.5	0.0	-10.8	-29.0
Velocity, FPS			2900	2681	2472	2273	2083	1902
Energy, Ft-Lb Per Grain			18.67	15.96	13.57	11.47	9.63	8.03
Time of Flight, Seconds			0.0000	0.1076	0.2241	0.3507	0.4886	0.6393
Bullet Path	Z	100 YDS	-1.5	0.0	-3.3	-12.4	-28.2	-52.0
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.4	-21.5	-43.6
Line of Sight	O	300 YDS	-1 5	4.1	4.9	0.0	-11.7	-31.4
Velocity, FPS			2800	2586	2381	2186	2000	1824
Energy, Ft-Lb Per Grain			17.41	14.85	12.59	10.61	8.88	7.39
Time of Flight, Seconds			0.0000	0.1115	0.2324	0.3639	0.5074	0.6644
Bullet Path	Z	100 YDS	-1.5	0.0	-3.7	-13.6	-30.7	-56.6
(Inches) +/-	E R	200 YDS	-1.5	1.9	0.0	-8.0	-23.3	-47.3
Line of Sight	O	300 YDS	-1.5	4.5	5.3	0.0	-12.6	-34.0
Velocity, FPS			2700	2490	2290	2099	1918	1747
Energy, Ft-Lb Per Grain			16.18	13.76	11.64	9.78	8.17	6.78
Time of Flight, Seconds			0.0000	0.1157	0.2413	0.3781	0.5277	0.6916
Bullet Path	Z	100 YDS	-1.5	0.0	-4.1	-14.9	-33.6	-61.7
(Inches) +/-	E R	200 YDS	-1.5	2.1	0.0	-8.7	-25.3	-51.4
Line of Sight	O	300 YDS	-1.5	5.0	5.8	0.0	-13.7	-36.9
Velocity, FPS			2600	2395	2199	2012	1836	1670
Energy, Ft-Lb Per Grain			15.01	12.73	10.74	8.99	7.48	6.19
Time of Flight, Seconds			0.0000	0.1202	0.2510	0.3936	0.5497	0.7210
Bullet Path	Z	100 YDS	-1.5	0.0	-4.6	-16.4	-36.7	-67.5
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-9.5	-27.6	-56.0
Line of Sight	O	300 YDS	-1.5	5.5	6.3	0.0	-14.9	-40.2
Velocity, FPS			2500	2299	2108	1926	1754	1595
Energy, Ft-Lb Per Grain			13.88	11.73	9.87	8.24	6.83	5.65
Time of Flight, Seconds			0.0000	0.1251	0.2614	0.4103	0.5735	0.7529
Bullet Path	Z	100 YDS	-1.5	0.0	-5.1	-18.0	-40.4	-74.0
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-10.4	-30.2	-61.3
Line of Sight	O	300 YDS	-1.5	6.0	6.9	0.0	-16.3	-44.0

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.43

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2400	2204	2017	1840	1674	1521
Energy, Ft-Lb Per Grain		12.79	10.78	9.03	7.52	6.22	5.14
Time of Flight, Seconds		0.0000	0.1304	0.2727	0.4285	0.5994	0.7875
Bullet Path	Z 100 YDS	-1.5	0.0	-5.7	-19.9	-44.5	-81.4
(Inches) +/-	E R 200 YDS	-1.5	2.8	0.0	-11.4	-33.1	-67.3
Line of Sight	O 300 YDS	-1.5	6.6	7.6	0.0	-17.9	-48.2
Velocity, FPS		2300	2109	1927	1755	1595	1449
Energy, Ft-Lb Per Grain		11.74	9.87	8.24	6.84	5.65	4.66
Time of Flight, Seconds		0.0000	0.1362	0.2851	0.4483	0.6276	0.8250
Bullet Path	Z 100 YDS	-1.5	0.0	-6.3	-22,1	-49.1	-89.9
(Inches) +/-	E R 200 YDS	-1.5	3.2	0.0	-12.6	-36.4	-74.0
Line of Sight	O 300 YDS	-1.5	7.4	8.4	0.0	-19.7	-53.1

Exterior Ballistic Table for Ballistic Coefficient 0.44

Velocity, FPS		3200	2971	2753	2546	2348	2158
Energy, Ft-Lb Per Grain		22.73	19.60	16.83	14.39	12.24	10.34
Time of Flight, Seconds		0.0000	0.0973	0.2022	0.3155	0.4383	0.5715
Bullet Path	Z 100 YDS	-1.5	0.0	-2.4	-9.5	-21.9	-40.6
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-5.8	-17.0	-34.5
Line of Sight	O 300 YDS	-1.5	3.2	3.9	0.0	-9.3	-24.8
Velocity, FPS		3100	2876	2663	2460	2265	2080
Energy, Ft-Lb Per Grain		21.33	18.36	15.74	13.43	11.39	9.60
Time of Flight, Seconds		0.0000	0.1005	0.2089	0.3261	0.4532	0.5914
Bullet Path	Z 100 YDS	-1.5	0.0	-2.7	-10.3	-23.7	-43.9
(Inches) +/-	E R 200 YDS	-1.5	1.4	0.0	-6.3	-18.3	-37.1
Line of Sight	O 300 YDS	-1.5	3.4	4.2	0.0	-9.9	-26.7
Velocity, FPS		3000	2781	2572	2373	2183	2001
Energy, Ft-Lb Per Grain		19.98	17.17	14.69	12.50	10.58	8.89
Time of Flight, Seconds		0.0000	0.1039	0.2160	0.3375	0.4693	0.6128
Bullet Path	Z 100 YDS	-1.5	0.0	-3.0	-11.3	-25.7	-47.5
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-6.8	-19.7	-40.0
Line of Sight	O 300 YDS	-1.5	3.8	4.5	0.0	-10.7	-28.7
Velocity, FPS		2900	2686	2482	2286	2100	1922
Energy, Ft-Lb Per Grain		18.67	16.02	13.68	11.60	9.79	8.20
Time of Flight, Seconds		0.0000	0.1075	0.2237	0.3497	0.4866	0.6359
Bullet Path	Z 100 YDS	-1.5	0.0	-3.3	-12.3	-28.0	-51.5
(Inches) +/-	E R 200 YDS	-1.5	1.7	0.0	-7.3	-21.3	-43.2
Line of Sight	O 300 YDS	-1.5	4.1	4.9	0.0	-11.5	-31.0
Velocity, FPS		2800	2591	2390	2199	2017	1844
Energy, Ft-Lb Per Grain		17.41	14.90	12.68	10.74	9.03	7.55
Time of Flight, Seconds		0.0000	0.1114	0.2320	0.3628	0.5053	0.6609
Bullet Path	Z 100 YDS	-1.5	0.0	-3.7	-13.5	-30.5	-56.0
(Inches) +/-	E R 200 YDS	-1.5	1.8	0.0	-7.9	-23.1	-46.8
Line of Sight	O 300 YDS	-1.5	4.5	5.3	0.0	-12.5	-33.6

Exterior Ballistic Table for Ballistic Coefficient 0.44

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2700	2495	2299	2112	1934	1766
Energy, Ft-Lb Per Grain		16.18	13.82	11.73	9.90	8.30	6.92
Time of Flight, Seconds		0.0000	0.1156	0.2408	0.3770	0.5254	0.6878
Bullet Path	Z 100 YDS	-1.5	0.0	-4.1	-14.8	-33.3	-61.1
(Inches) +/-	E R 200 YDS	-1.5	2.0	0.0	-8.6	-25.1	-50.9
Line of Sight	O 300 YDS	-1.5	4.9	5.8	0.0	-13.6	-36.5
Velocity, FPS		2600	2400	2208	2025	1851	1688
Energy, Ft-Lb Per Grain		15.01	12.79	10.82	9.10	7.61	6.33
Time of Flight, Seconds		0.0000	0.1201	0.2505	0.3924	0.5473	0.7170
Bullet Path	Z 100 YDS	-1.5	0.0	-4.6	-16.3	-36.5	-66.8
(Inches) +/-	E R 200 YDS	-1.5	2.3	0.0	-9.4	-27.4	-55.4
Line of Sight	O 300 YDS	-1.5	5.4	6.3	0.0	-14.8	-39.7
Velocity, FPS		2500	2304	2116	1938	1770	1612
Energy Ft-Lb Per Grain		13.88	11.79	9.94	8.34	6.96	5.77
Time of Flight, Seconds		0.0000	0.1250	0.2609	0.4090	0.5710	0.7487
Bullet Path	Z 100 YDS	-1.5	0.0	-5.1	-17.9	-40.0	-73 3
(Inches) +/-	E R 200 YDS	-1.5	2.5	0.0	-10.3	-29.9	-60 6
Line of Sight	O 300 YDS	-1.5	6.0	6.9	0.0	-16.2	-43.4
Velocity, FPS		2400	2208	2025	1852	1689	1538
Energy, Ft-Lb Per Grain		12.79	10.82	9.10	7.61	6.33	5.25
Time of Flight, Seconds		0.0000	0.1303	0.2722	0 4271	0.5968	0.7830
Bullet Path	Z 100 YDS	-1.5	0.0	-5.6	-19.8	-44.1	-80.6
(Inches) +/-	E R 200 YDS	-1.5	2.8	0.0	-11.3	-32.8	-66.5
Line of Sight	O 300 YDS	-1.5	6.6	7.5	0.0	-17.7	-47.6
Velocity, FPS		2300	2113	1935	1765	1609	1465
Energy, Ft-Lb Per Grain		11.74	9.91	8.31	6.92	5.75	4.76
Time of Flight, Seconds		0.0000	0.1361	0.2845	0.4468	0.6248	0.8203
Bullet Path	Z 100 YDS	-1.5	0.0	-6.3	-21.9	-48.7	-89.0
(Inches) +/-	E R 200 YDS	-1.5	3.2	0.0	-12.5	-36.1	-73.2
Line of Sight	O 300 YDS	-1.5	7.3	8.3	0.0	-19.5	-52.4
Velocity, FPS		2200	2017	1844	1682	1531	1394
Energy, Ft-Lb Per Grain		10.75	9.03	7.55	6.28	5.20	4.31
Time of Flight, Seconds		0.0000	0.1424	0.2979	0.4683	0.6553	0.8607
Bullet Path	Z 100 YDS	-1.5	0.0	-7.1	-24.4	-54.0	-98.5
(Inches) +/-	E R 200 YDS	-1.5	3.5	0.0	-13.8	-39.9	-80.8
Line of Sight	O 300 YDS	-1.5	8.1	9.2	0.0	-21.5	-57.9
Velocity, FPS		2100	1922	1755	1599	1455	1327
Energy, Ft-Lb Per Grain		9.79	8.20	6.84	5.68	4.70	3.91
Time of Flight, Seconds		0.0000	0.1493	0.3127	0.4918	0.6886	0.9046
Bullet Path	Z 100 YDS	-1.5	0.0	-7.9	-27.2	-60.1	-109.4
(Inches) +/-	E R 200 YDS	-1.5	4.0	0.0	-15.3	-44.2	-89.6
Line of Sight	O 300 YDS	-1.5	9.1	10.2	0.0	-23.8	-64.1

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.44

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2000	1828	1666	1517	1382	1263
Energy, Ft Lb Per Grain			8.88	7.42	6.16	5.11	4.24	3.54
Time of Flight, Seconds			0.0000	0.1569	0.3288	0.5176	0.7249	0.9522
Bullet Path	Z	100 YDS	-1.5	0.0	-8.9	-30.4	-67.0	-121.9
(Inches) +/-	E R	200 YDS	-1.5	4.5	0.0	-17.0	-49.2	-99.6
Line of Sight	O	300 YDS	-1.5	10.1	11.3	0.0	-26.5	-71.2

Exterior Ballistic Table for Ballistic Coefficient 0.45

Velocity, FPS			2900	2691	2490	2299	2116	1941
Energy, Ft Lb Per Grain			18.67	16.08	13.76	11.73	9.94	8.36
Time of Flight, Seconds			0.0000	0.1074	0.2233	0.3487	0.4847	0.6327
Bullet Path	Z	100 YDS	-1.5	0.0	-3.3	-12.2	-27.8	-51.1
(Inches) +/-	E R	200 YDS	-1.5	1.7	0.0	-7.3	-21.1	-42.8
Line of Sight	O	300 YDS	-1.5	4.1	4.8	0.0	-11.4	-30.7

Velocity, FPS			2800	2595	2399	2212	2033	1862
Energy, Ft-Lb Per Grain			17.41	14.95	12.78	10.86	9.18	7.70
Time of Flight, Seconds			0.0000	0.1113	0.2315	0.3618	0.5033	0.6575
Bullet Path	Z	100 YDS	-1.5	0.0	-3.7	-13.4	-30.2	-55.5
(Inches) +/-	E R	200 YDS	-1.5	1.8	0.0	-7.9	-22.9	-46.3
Line of Sight	O	300 YDS	-1.5	4.5	5.3	0.0	-12.4	-33.2

Velocity, FPS			2700	2500	2308	2124	1949	1784
Energy, Ft-Lb Per Grain			16.18	13.88	11.83	10.02	8.43	7.07
Time of Flight, Seconds			0.0000	0.1155	0.2404	0.3759	0.5233	0.6842
Bullet Path	Z	100 YDS	1.5	0.0	-4.1	-14.7	-33.0	-60.5
(Inches) +/-	E R	200 YDS	-1.5	2.0	0.0	-8.6	-24.9	-50.4
Line of Sight	O	300 YDS	-1.5	4.9	5.7	0.0	-13.4	-36.1

Velocity, FPS			2600	2404	2216	2037	1866	1706
Energy, Ft-Lb Per Grain			15.01	12.83	10.90	9.21	7.73	6.46
Time of Flight, Seconds			0.0000	0.1200	0.2500	0.3912	0.5451	0.7132
Bullet Path	Z	100 YDS	-1.5	0.0	-4.5	-16.2	-36.2	-66.2
(Inches) +/-	E R	200 YDS	-1.5	2.3	0.0	-9.4	-27.1	-54.9
Line of Sight	O	300 YDS	-1.5	5.4	6.2	0.0	-14.6	-39.3

Velocity, FPS			2500	2308	2125	1950	1784	1629
Energy, Ft-Lb Per Grain			13.88	11.83	10.02	8.44	7.07	5.89
Time of Flight, Seconds			0.0000	0.1249	0.2604	0.4078	0.5686	0.7447
Bullet Path	Z	100 YDS	-1.5	0.0	-5.0	-17.8	-39.7	-72.6
(Inches) +/-	E R	200 YDS	-1.5	2.5	0.0	-10.2	-29.6	-60.0
Line of Sight	O	300 YDS	-1.5	5.9	6.8	0.0	-16.0	-42.9

Velocity, FPS			2400	2212	2033	1863	1703	1554
Energy, Ft-Lb Per Grain			12.79	10.86	9.18	7.71	6.44	5.36
Time of Flight, Seconds			0.0000	0.1302	0.2716	0.4258	0.5943	0.7787
Bullet Path	Z	100 YDS	-1.5	0.0	-5.6	-19.7	-43.8	-79.9
(Inches) +/-	E R	200 YDS	-1.5	2.8	0.0	-11.2	-32.5	-65.8
Line of Sight	O	300 YDS	-1.5	6.6	7.5	0.0	-17.5	-47.1

Exterior Ballistic Table for Ballistic Coefficient 0.45

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2300	2117	1942	1777	1623	1480
Energy, Ft-Lb Per Grain		11.74	9.95	8.37	7.01	5.85	4.86
Time of Flight, Seconds		0.0000	0.1360	0.2839	0.4454	0.6221	0.8158
Bullet Path	Z 100 YDS	-1.5	0.0	-6.3	-21.8	-48.3	-88.1
(Inches) +/-	E R 200 YDS	-1.5	3.1	0.0	-12.4	-35.8	-72.4
Line of Sight	O 300 YDS	-1.5	7.3	8.3	0.0	-19.3	-51.8
Velocity, FPS		2200	2021	1852	1692	1544	1409
Energy, Ft-Lb Per Grain		10.75	9.07	7.61	6.36	5.29	4.41
Time of Flight, Seconds		0.0000	0.1423	0.2973	0.4668	0.6525	0.8560
Bullet Path	Z 100 YDS	-1.5	0.0	-7.0	-24.2	-53.6	-97.6
(Inches) +/-	E R 200 YDS	-1.5	3.5	0.0	-13.7	-39.5	-80.0
Line of Sight	O 300 YDS	-1.5	8.1	9.1	0.0	-21.3	-57.2
Velocity, FPS		2100	1926	1762	1609	1468	1340
Energy, Ft-Lb Per Grain		9.79	8.24	6.89	5 75	4.78	3.99
Time of Flight, Seconds		0.0000	0.1492	0.3120	0.4902	0.6856	0.8996
Bullet Path	Z 100 YDS	-1.5	0.0	-7.9	-27.0	-59.6	-108.4
(Inches) +/-	E R 200 YDS	-1.5	3.9	0.0	-15.2	-43.8	-88.6
Line of Sight	O 300 YDS	-1.5	9.0	10.1	0 0	-23.6	-63.3
Velocity, FPS		2000	1832	1673	1527	1393	1275
Energy, Ft-Lb Per Grain		8.88	7.45	6.21	5.18	4.31	3.61
Time of Flight, Seconds		0.0000	0.1568	0.3282	0.5159	0.7217	0.9470
Bullet Path	Z 100 YDS	-1.5	0.0	-8.9	-30.2	-66.5	-120.8
(Inches) +/-	E R 200 YDS	-1.5	4.4	0.0	-16.9	-48.7	-98.5
Line of Sight	O 300 YDS	-1.5	10.1	11.3	0.0	-26.2	-70.4
Velocity, FPS		1900	1737	1586	1447	1322	1214
Energy, Ft-Lb Per Grain		8.01	6.70	5.58	4.65	3.88	3.27
Time of Flight, Seconds		0.0000	0.1651	0.3459	0.5441	0.7612	0.9983
Bullet Path	Z 100 YDS	-1.5	0.0	-10.0	-34.0	-74.5	-135.0
(Inches) +/-	E R 200 YDS	-1.5	5.0	0.0	-18.9	-54.4	-109.9
Line of Sight	O 300 YDS	-1.5	11.3	12 6	0.0	-29.2	-78.4

Exterior Ballistic Table for Ballistic Coefficient 0.46

Velocity, FPS		3300	3075	2862	2659	2464	2278
Energy, Ft-Lb Per Grain		24.18	20.99	18.18	15.70	13.48	11.52
Time of Flight, Seconds		0.0000	0.0942	0.1953	0.3041	0.4213	0.5479
Bullet Path	Z 100 YDS	-1.5	0.0	-2.2	-8.6	-20.0	-37.1
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.3	-15.6	-31.6
Line of Sight	O 300 YDS	-1.5	2.9	3.6	0.0	-8.5	-22.7
Velocity, FPS		3200	2980	2772	2572	2382	2199
Energy, Ft-Lb Per Grain		22.73	19.72	17.06	14.69	12.60	10.74
Time of Flight, Seconds		0.0000	0.0972	0.2015	0.3139	0.4351	0.5662
Bullet Path	Z 100 YDS	-1.5	0.0	-2 4	-9.4	-21.6	-39.9
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-5.7	-16.7	-33.9
Line of Sight	O 300 YDS	-1.5	3.1	3.8	0.0	-9.1	-24.3

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.46

RANGE	MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS	3100	2885	2681	2486	2299	2119
Energy, Ft-Lb Per Grain	21.33	18.48	15.96	13.72	11.73	9.97
Time of Flight, Seconds	0.0000	0.1003	0.2082	0 3244	0.4499	0.5858
Bullet Path Z 100 YDS	-1.5	0.0	-2.7	-10.2	-23.4	-43.1
(Inches) +/- E R 200 YDS	-1.5	1.3	0.0	-6 2	-18.0	-36.4
Line of Sight O 300 YDS	-1.5	3.4	4.1	0.0	-9.8	-26.1
Velocity, FPS	3000	2790	2590	2399	2215	2040
Energy, Ft-Lb Per Grain	19.98	17.28	14.89	12.78	10.89	9.24
Time of Flight, Seconds	0 0000	0.1037	0.2153	0.3357	0.4658	0.6070
Bullet Path Z 100 YDS	-1.5	0.0	-3.0	-11.1	-25.4	-46.7
(Inches) +/- E R 200 YDS	-1.5	1.5	0.0	-6.7	-19.4	-39.2
Line of Sight O 300 YDS	-1.5	3.7	4.5	0.0	-10.5	-28.1
Velocity, FPS	2900	2695	2499	2311	2132	1960
Energy, Ft-Lb Per Grain	18.67	16.12	13.86	11.86	10.09	8.53
Time of Flight, Seconds	0.0000	0.1073	0.2229	0.3478	0.4829	0.6297
Bullet Path Z 100 YDS	-1.5	0.0	-3.3	-12 2	-27.6	-50.6
(Inches) +/- E R 200 YDS	-1.5	1.6	0.0	-7.2	-21.0	-42.4
Line of Sight O 300 YDS	-1.5	4.1	4.8	0.0	-11.3	-30.3
Velocity, FPS	2800	2599	2408	2224	2048	1880
Energy, Ft-Lb Per Grain	17.41	15.00	12.87	10.98	9.31	7.85
Time of Flight, Seconds	0.0000	0.1112	0.2311	0.3608	0.5014	0.6543
Bullet Path Z 100 YDS	-1.5	0.0	-3.7	-13.3	-30.0	-55.0
(Inches) +/- E R 200 YDS	-1.5	1.8	0.0	-7.8	-22.7	-45.9
Line of Sight O 300 YDS	-1.5	4.4	5 2	0.0	-12.3	-32.9
Velocity, FPS	2700	2504	2316	2136	1964	1801
Energy, Ft-Lb Per Grain	16.18	13.92	11.91	10.13	8.56	7.20
Time of Flight, Seconds	0.0000	0.1154	0.2400	0.3749	0.5213	0.6809
Bullet Path Z 100 YDS	-1.5	0.0	-4.1	-14.6	-32.8	-60.0
(Inches) +/- E R 200 YDS	-1.5	2.0	0.0	-8.5	-24.7	-49.9
Line of Sight O 300 YDS	-1.5	4.9	5.7	0.0	-13.3	-35.7
Velocity, FPS	2600	2408	2224	2048	1881	1723
Energy, Ft-Lb Per Grain	15.01	12.87	10 98	9.31	7.85	6.59
Time of Flight, Seconds	0.0000	0.1199	0.2495	0.3901	0.5430	0.7096
Bullet Path Z 100 YDS	-1.5	0.0	-4.5	-16.1	-35.9	-65.6
(Inches) +/- E R 200 YDS	-1.5	2.3	0.0	-9.3	-26.9	-54.4
Line of Sight O 300 YDS	-1.5	5.4	6.2	0.0	-14.5	-38.9
Velocity, FPS	2500	2312	2132	1961	1798	1646
Energy, Ft-Lb Per Grain	13.88	11.87	10.09	8.54	7.18	6.01
Time of Flight, Seconds	0.0000	0.1248	0.2599	0.4066	0.5664	0.7408
Bullet Path Z 100 YDS	-1. 5	0.0	-5.0	-17.7	-39.4	-72.0
(Inches) +/- E R 200 YDS	-1.5	2.5	0.0	-10.2	-29.4	-59.4
Line of Sight O 300 YDS	-1.5	5.9	6.8	0.0	-15.8	-42.5

SPEER LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.46

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2400	2216	2041	1874	1716	1570
Energy, Ft-Lb Per Grain		12.79	10.90	9.25	7.80	6.54	5.47
Time of Flight, Seconds		0.0000	0.1301	0.2711	0.4246	0.5919	0.7747
Bullet Path	Z 100 YDS	-1.5	0.0	-5.6	-19.6	-43.4	-79.1
(Inches) +/-	E R 200 YDS	-1.5	2.8	0.0	-11.2	-32.2	-65.2
Line of Sight	O 300 YDS	-1.5	6.5	7.4	0.0	-17.4	-46.6
Velocity. FPS		2300	2121	1950	1788	1636	1495
Energy, Ft-Lb Per Grain		11.74	9.99	8.44	7.10	5.94	4.96
Time of Flight, Seconds		0.0000	0.1358	0.2834	0.4441	0.6196	0.8115
Bullet Path	Z 100 YDS	-1.5	0.0	-6.2	-21.7	-48.0	-87.3
(Inches) +/-	E R 200 YDS	-1.5	3.1	0.0	-12.3	-35.5	-71.7
Line of Sight	O 300 YDS	-1.5	7.2	8.2	0.0	-19.1	-51.2
Velocity, FPS		2200	2025	1859	1702	1557	1423
Energy, Ft-Lb Per Grain		10.75	9.10	7.67	6.43	5.38	4.50
Time of Flight, Seconds		0.0000	0.1421	0.2968	0.4654	0.6498	0.8514
Bullet Path	Z 100 YDS	-1.5	0.0	-7.0	-24.1	-53.2	-96.7
(Inches) +/-	E R 200 YDS	-1.5	3.5	0.0	-13.6	-39.2	-79.2
Line of Sight	O 300 YDS	-1.5	8.0	9.1	0.0	-21.1	-56.5
Velocity, FPS		2100	1930	1769	1618	1479	1353
Energy, Ft-Lb Per Grain		9.79	8.27	6.95	5.81	4.86	4.06
Time of Flight, Seconds		0.0000	0.1490	0.3114	0.4887	0.6827	0.8949
Bullet Path	Z 100 YDS	-1.5	0.0	-7.9	-26.8	-59.1	-107.4
(Inches) +/-	E R 200 YDS	-1.5	3.9	0.0	-15.1	-43.4	-87.7
Line of Sight	O 300 YDS	-1.5	8.9	10.0	0.0	-23.3	-62.6
Velocity, FPS		2000	1835	1680	1536	1404	1287
Energy, Ft-Lb Per Grain		8.88	7.48	6.27	5.24	4.38	3.68
Time of Flight, Seconds		0.0000	0.1566	0.3275	0.5143	0.7187	0.9420
Bullet Path	Z 100 YDS	-1.5	0.0	-8.8	-30.0	-66.0	-119.6
(Inches) +/-	E R 200 YDS	-1.5	4.4	0.0	-16.8	-48.3	-97.5
Line of Sight	O 300 YDS	-1.5	10.0	11.2	0.0	-26.0	-69 6
Velocity, FPS		1900	1741	1592	1455	1332	1225
Energy, Ft-Lb Per Grain		8.01	6.73	5.63	4.70	3.94	3.33
Time of Flight, Seconds		0.0000	0.1650	0.3452	0.5424	0.7580	0.9931
Bullet Path	Z 100 YDS	-1.5	0.0	-10.0	-33.7	-73.9	-133.8
(Inches) +/-	E R 200 YDS	-1.5	5.0	0.0	-18.7	-53.9	-108.8
Line of Sight	O 300 YDS	-1.5	11.2	12.5	0.0	-28.9	-77.5

Exterior Ballistic Table for Ballistic Coefficient 0.48

Velocity, FPS		3300	3084	2879	2683	2496	2316
Energy, Ft-Lb Per Grain		24.18	21.12	18.40	15.98	13.83	11.91
Time of Flight, Seconds		0.0000	0.0940	0.1947	0.3027	0.4186	0.5434
Bullet Path	Z 100 YDS	-1.5	0.0	-2.2	-8.5	-19.7	-36.5
(Inches) +/-	E R 200 YDS	-1 5	1.1	0.0	-5.3	-15.4	-31.1
Line of Sight	O 300 YDS	-1.5	2.8	3.5	0.0	-8.4	-22.3

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.48

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3200	2989	2789	2597	2413	2236
Energy, Ft-Lb Per Grain		22.73	19.83	17.27	14.97	12.93	11.10
Time of Flight, Seconds		0.0000	0.0970	0.2009	0.3124	0.4323	0.5614
Bullet Path	Z 100 YDS	-1.5	0.0	-2.4	-9.3	-21.3	-39.3
(Inches) +/-	E 200 YDS	-1.5	1.2	0.0	-5.7	-16.5	-33.3
Line of Sight	R O 300 YDS	-1.5	3.1	3.8	0.0	-8.9	-23.9
Velocity, FPS		3100	2894	2698	2510	2329	2156
Energy, Ft-Lb Per Grain		21.33	18.59	16.16	13.99	12.04	10.32
Time of Flight, Seconds		0.0000	0.1002	0 2075	0.3228	0.4469	0.5808
Bullet Path	Z 100 YDS	-1.5	0.0	-2.7	-10.1	-23.1	-42.5
(Inches) +/-	E 200 YDS	-1.5	1.3	0.0	-6.1	-17.8	-35.8
Line of Sight	R O 300 YDS	-1.5	3.4	4.1	0.0	-9.6	-25.6
Velocity, FPS		3000	2799	2607	2422	2245	2076
Energy, Ft-Lb Per Grain		19.98	17.39	15.09	13.02	11.19	9.57
Time of Flight, Seconds		0.0000	0.1035	0.2146	0.3340	0.4627	0.6016
Bullet Path	Z 100 YDS	-1.5	0.0	-2.9	-11.0	-25.0	-45.9
(Inches) +/-	E 200 YDS	-1.5	1.5	0.0	-6.6	-19.1	-38.6
Line of Sight	R O 300 YDS	-1.5	3.7	4.4	0.0	-10.3	-27.6
Velocity, FPS		2900	2703	2515	2334	2161	1995
Energy, Ft-Lb Per Grain		18.67	16.22	14.04	12.09	10.37	8.84
Time of Flight, Seconds		0.0000	0.1072	0.2222	0.3460	0.4796	0.6241
Bullet Path	Z 100 YDS	-1.5	0.0	-3.3	-12.0	-27.2	-49.8
(Inches) +/-	E 200 YDS	-1.5	1.6	0.0	-7.1	-20.7	-41.7
Line of Sight	R O 300 YDS	-1.5	4.0	4.8	0.0	-11.2	-29.8
Velocity, FPS		2800	2608	2423	2246	2077	1915
Energy, Ft-Lb Per Grain		17.41	15.10	13.03	11.20	9.58	8.14
Time of Flight, Seconds		0.0000	0.1110	0.2304	0.3590	0.4979	0 6484
Bullet Path	Z 100 YDS	-1.5	0.0	-3.6	- 13.2	-29.6	-54.2
(Inches) +/-	E 200 YDS	-1.5	1.8	0.0	-7.7	-22.4	-45.1
Line of Sight	R O 300 YDS	-1.5	4.4	5.2	0.0	-12.1	-32.2
Velocity, FPS		2700	2512	2331	2158	1992	1834
Energy, Ft-Lb Per Grain		16.18	14.01	12.06	10.34	8.81	7.47
Time of Flight, Seconds		0.0000	0.1152	0.2392	0.3729	0 5176	0.6746
Bullet Path	Z 100 YDS	-1.5	0.0	-4.0	-14.4	-32.4	-59.0
(Inches) +/-	E 200 YDS	-1.5	2.0	0.0	-8.4	-24.3	-49.0
Line of Sight	R O 300 YDS	-1.5	4.8	5.6	0.0	-13.1	-35.0
Velocity, FPS		2600	2416	2239	2070	1908	1755
Energy, Ft-Lb Per Grain		15.01	12.96	11.13	9.51	8.08	6.84
Time of Flight, Seconds		0.0000	0.1197	0.2487	0.3881	0.5390	0.7030
Bullet Path	Z 100 YDS	-1.5	0.0	-4.5	-15.9	-35.4	-64.5
(Inches) +/-	E 200 YDS	-1.5	2.2	0.0	-9.2	-26.5	-53.4
Line of Sight	R O 300 YDS	-1.5	5.3	6.1	0.0	-14.3	-38.1

Exterior Ballistic Table for Ballistic Coefficient 0.48

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2500	2320	2147	1982	1825	1676
Energy, Ft-Lb Per Grain		13.88	11.95	10.23	8.72	7.39	6.24
Time of Flight, Seconds		0.0000	0.1246	0.2590	0.4044	0.5622	0 7338
Bullet Path	Z 100 YDS	-1.5	0.0	-5.0	-17.5	-38.9	-70.8
(Inches) +/-	E R 200 YDS	-1.5	2.5	0.0	-10.0	-29.0	-58.3
Line of Sight	O 300 YDS	-1.5	5.8	6.7	0.0	-15.6	-41.6
Velocity, FPS		2400	2224	2055	1894	1742	1599
Energy, Ft-Lb Per Grain		12.79	10.98	9.38	7.96	6.74	5.68
Time of Flight, Seconds		0.0000	0.1299	0.2702	0.4222	0.5874	0 7672
Bullet Path	Z 100 YDS	-1.5	0.0	-5.5	-19.3	-42.8	-77.8
(Inches) +/-	E R 200 YDS	-1.5	2.8	0.0	-11.0	-31.7	-64.0
Line of Sight	O 300 YDS	-1.5	6.4	7.3	0.0	-17.1	-45.6
Velocity, FPS		2300	2128	1964	1807	1660	1524
Energy, Ft-Lb Per Grain		11.74	10.05	8.56	7.25	6.12	5.16
Time of Flight, Seconds		0.0000	0.1356	0.2824	0 4416	0.6149	0.8035
Bullet Path	Z 100 YDS	-1.5	0.0	-6.2	-21.4	-47.3	-85.9
(inches) +/-	E R 200 YDS	-1.5	3.1	0.0	-12.1	-34.9	-70.4
Line of Sight	O 300 YDS	-1.5	7.1	8.1	0.0	-18.8	-50.1
Velocity, FPS		2200	2032	1873	1721	1580	1450
Energy, Ft-Lb Per Grain		10.75	9.17	7.79	6.58	5.54	4.67
Time of Flight, Seconds		0.0000	0.1419	0.2957	0.4628	0.6447	0.8430
Bullet Path	Z 100 YDS	-1.5	0.0	-6.9	-23.8	-52.4	-95.0
(Inches) +/-	E R 200 YDS	-1.5	3.5	0.0	-13.4	-38.6	-77.7
Line of Sight	O 300 YDS	-1.5	7.9	8.9	0.0	-20.7	-55 3
Velocity, FPS		2100	1937	1782	1637	1502	1378
Energy, Ft-Lb Per Grain		9.79	8.33	7.05	5.95	5.01	4.22
Time of Flight, Seconds		0.0000	0.1488	0.3102	0 4859	0.6774	0.8860
Bullet Path	Z 100 YDS	-1.5	0.0	-7.8	-26.5	-58.3	-105.5
(Inches) +/-	E R 200 YDS	-1.5	3.9	0.0	-14.9	-42.7	-86.1
Line of Sight	O 300 YDS	-1.5	8.8	9.9	0.0	-22.9	-61.3
Velocity, FPS		2000	1842	1693	1553	1425	1310
Energy, Ft-Lb Per Grain		8.88	7.53	6.36	5.35	4.51	3.81
Time of Flight, Seconds		0.0000	0.1563	0.3263	0.5113	0.7130	0.9327
Bullet Path	Z 100 YDS	-1.5	0.0	-8.8	-29.7	-65.1	-117.6
(Inches) +/-	E R 200 YDS	-1.5	4.4	0.0	-16.5	-47.5	-95.7
Line of Sight	O 300 YDS	-1.5	9.9	11.0	0.0	-25.5	-68.1
Velocity, FPS		1900	1747	1604	1472	1351	1246
Energy, Ft-Lb Per Grain		8.01	6.78	5.71	4.81	4.05	3.45
Time of Flight, Seconds		0.0000	0.1647	0.3439	0.5392	0.7521	0.9835
Bullet Path	Z 100 YDS	-1.5	0.0	-9.9	-33.4	-72.9	-131.5
(Inches) +/-	E R 200 YDS	-1.5	5.0	0.0	-18.5	-53.1	-106.7
Line of Sight	O 300 YDS	-1.5	11.1	12.3	0.0	-28.4	-75.9

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.50

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		3300	3093	2895	2706	2525	2351
Energy, Ft-Lb Per Grain		24.18	21.24	18.61	16.26	14.15	12.27
Time of Flight, Seconds		0.0000	0.0939	0.1942	0.3014	0.4161	0.5392
Bullet Path	Z 100 YDS	-1.5	0.0	-2.1	-8.4	-19.5	-36.0
(Inches) +/-	E R 200 YDS	-1.5	1.1	0.0	-5.2	-15.2	-30.6
Line of Sight	O 300 YDS	-1.5	2.8	3.5	0.0	-8.2	-21.9
Velocity, FPS		3200	2998	2804	2619	2442	2271
Energy, Ft-Lb Per Grain		22.73	19.95	17.46	15.23	13.24	11.45
Time of Flight, Seconds		0.0000	0.0969	0.2004	0.3110	0.4297	0.5571
Bullet Path	Z 100 YDS	-1.5	0.0	-2.4	-9.2	-21.0	-38.8
(Inches) +/-	E R 200 YDS	-1.5	1.2	0.0	-5.6	-16.3	-32.8
Line of Sight	O 300 YDS	-1.5	3.1	3.7	0.0	-8.8	-23.5
Velocity, FPS		3100	2902	2713	2532	2358	2190
Energy, Ft-Lb Per Grain		21.33	18.70	16.34	14.23	12.34	10.65
Time of Flight, Seconds		0.0000	0.10000	0.2069	0.3214	0.4442	0.5762
Bullet Path	Z 100 YDS	-1.5	0.0	-2.6	-10.0	-22.8	-41.8
(Inches) +/-	E R 200 YDS	-1.5	1.3	0.0	-6.0	-17.5	-35.3
Line of Sight	O 300 YDS	-1.5	3.3	4.0	0.0	-9.5	-25.2
Velocity, FPS		3000	2807	2622	2444	2273	2109
Energy, Ft-Lb Per Grain		19.98	17.49	15.26	13.26	11.47	9.87
Time of Flight, Seconds		0.0000	0.1034	0.2140	0.3325	0.4598	0.5968
Bullet Path	Z 100 YDS	-1.5	0.0	-2.9	-10.9	-24.7	-45.3
(Inches) +/-	E R 200 YDS	-1.5	1.5	0.0	-6.5	-18.9	-38.0
Line of Sight	O 300 YDS	-1.5	3.6	4.4	0.0	-10.2	-27.1
Velocity, FPS		2900	2711	2530	2356	2188	2028
Energy, Ft-Lb Per Grain		18.67	16.32	14.21	12.32	10.63	9.13
Time of Flight, Seconds		0.0000	01070	0.2216	0.3445	0.4766	0.6190
Bullet Path	Z 100 YDS	-1.5	0.0	-3.2	-11.9	-26.9	-49.1
(Inches) +/-	E R 200 YDS	-1.5	1.6	0.0	-7.1	-20.4	-41.0
Line of Sight	O 300 YDS	-1.5	4.0	4.7	0.0	-11.0	-29.2
Velocity, FPS		2800	2615	2438	2267	2103	1946
Energy, Ft-Lb Per Grain		17.41	15.18	13.20	11.41	9.82	8.41
Time of Flight, Seconds		0.0000	0.1109	0.2297	0.3573	0.4947	0.6430
Bullet Path	Z 100 YDS	-1.5	0.0	-3.6	-13.0	-29.3	-53.4
(Inches) +/-	E R 200 YDS	-1.5	1.8	0.0	-7.7	-22.1	-44.4
Line of Sight	O 300 YDS	-1.5	4.3	5.1	0.0	-11.9	-31.6
Velocity, FPS		2700	2519	2345	2178	2018	1865
Energy, Ft-Lb Per Grain		16.18	14.09	12.21	10.53	9.04	7.72
Time of Flight, Seconds		0.0000	0.1150	0.2385	0.3712	0.5143	0.6689
Bullet Path	Z 100 YDS	-1.5	0.0	-4.0	-14.3	-32.0	-58.2
(Inches) +/-	E R 200 YDS	-1.5	2.0	0.0	-8.3	-24.0	-48.2
Line of Sight	O 300 YDS	-1.5	4.8	5.5	0.0	-12.9	-34.3

SPEER

LONG RANGE TABLES

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.50

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2600	2423	2253	2090	1933	1785
Energy, Ft-Lb Per Grain		15.01	13.03	11.27	9.70	8.30	7.07
Time of Flight, Seconds		0.0000	0.1195	0.2479	0.3862	0.5354	0.6970
Bullet Path	Z 100 YDS	-1.5	0.0	-4.4	-15.7	-35.0	-63.6
(Inches) +/-	E 200 YDS	-1.5	2.2	0.0	-9.1	-26.1	-52.5
Line of Sight	R O 300 YDS	-1.5	5.2	6.1	0.0	-14.0	-37.4
Velocity, FPS		2500	2327	2161	2001	1849	1705
Energy Ft-Lb Per Grain		13 88	12.02	10.37	8.89	7.59	6.45
Time of Flight, Seconds		0.0000	0.1244	0.2582	0.4025	0.5584	0.7274
Bullet Path	Z 100 YDS	-1.5	0.0	-4.9	-17.3	-38.4	-69.7
(Inches) +/-	E 200 YDS	-1.5	2.5	0.0	-9.9	-28.5	-57.4
Line of Sight	R O 300 YDS	-1.5	5.8	6.6	0.0	-15.3	-40.8
Velocity, FPS		2400	2231	2068	1913	1766	1627
Energy, Ft-Lb Per Grain		12.79	11.05	9.49	8.12	6.92	5.88
Time of Flight, Seconds		0.0000	0.1297	0.2693	0.4201	0.5834	0.7604
Bullet Path	Z 100 YDS	-1.5	0.0	-5.5	-19.1	-42.3	-76.6
(Inches) +/-	E 200 YDS	-1.5	2.7	0.0	-10.9	-31.3	-62.9
Line of Sight	R O 300 YDS	-1.5	6.4	7.3	0.0	-16.8	-44.7
Velocity, FPS		2300	2135	1977	1826	1683	1550
Energy, Ft-Lb Per Grain		11.74	10.12	8.68	7.40	6.29	5.33
Time of Flight, Seconds		0.0000	0.1354	0.2814	0.4394	0.6106	0.7963
Bullet Path	Z 100 YDS	-1.5	0.0	-6.1	-21.2	-46.7	-84.5
(Inches) +/-	E 200 YDS	-1.5	3.1	0.0	-12.0	-34.4	-69.2
Line of Sight	R O 300 YDS	-1.5	7.1	8.0	0.0	-18.4	-49.2
Velocity, FPS		2200	2039	1885	1739	1602	1475
Energy, Ft-Lb Per Grain		10.75	9.23	7.89	6.71	5.70	4.83
Time of Flight, Seconds		0.0000	0.1417	0.2947	0.4604	0.6402	0.8354
Bullet Path	Z 100 YDS	-1.5	0.0	-6.9	-23.6	-51.8	-93.5
(Inches) +/-	E 200 YDS	-1.5	3.4	0.0	-13.2	-38.0	-76.3
Line of Sight	R O 300 YDS	-1.5	7.9	8.8	0.0	-20.3	-54.3
Velocity, FPS		2100	1943	1794	1654	1523	1402
Energy Ft-Lb Per Grain		9.79	8.38	7.15	6.07	5.15	4.36
Time of Flight, Seconds		0.0000	0.1485	0.3092	0.4834	0.6725	0.8780
Bullet Path	Z 100 YDS	-1.5	0.0	-7.7	-26.3	-57.6	-103.9
(Inches) +/-	E 200 YDS	-1.5	3.9	0.0	-14.7	-42.1	-84.6
Line of Sight	R O 300 YDS	-1.5	8.8	9.8	0.0	-22.5	-60.1
Velocity, FPS		2000	1848	1704	1569	1445	1332
Energy, Ft-Lb Per Grain		8.88	7.58	6.45	5.47	4.64	3.94
Time of Flight, Seconds		0.0000	0.1561	0.3251	0.5086	0.7079	0.9243
Bullet Path	Z 100 YDS	-1.5	0.0	-8.7	-29.4	-64.2	-115.8
(Inches) +/-	E 200 YDS	-1.5	4.4	0.0	-16.3	-46.8	-94.0
Line of Sight	R O 300 YDS	-1.5	9.8	10.9	0.0	-25.0	-66.8

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.50

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity FPS		1900	1753	1615	1487	1370	1266
Energy, Ft-Lb Per Grain		8.01	6.82	5.79	4.91	4.17	3.56
Time of Flight, Seconds		0.0000	0.1644	0.3427	0.5363	0.7467	0.9747
Bullet Path	Z 100 YDS	-1.5	0.0	-9.8	-33.0	-72.0	-129.4
(Inches) +/-	E 200 YDS	-1.5	4.9	0.0	-18.3	-52.3	-104.9
Line of Sight	R O 300 YDS	-1.5	11.0	12.2	0.0	-27.9	-74.4

Exterior Ballistic Table for Ballistic Coefficient 0.54

Velocity, FPS		3100	2917	2741	2571	2408	2251
Energy, Ft-Lb Per Grain		21.33	18.89	16.68	14.67	12.87	11.25
Time of Flight, Seconds		0.0000	0.0998	0.2059	0.3189	0.4395	0.5683
Bullet Path	Z 100 YDS	-1.5	0.0	-2.6	-9.8	-22.3	-40.8
(Inches) +/-	E 200 YDS	-1.5	1.3	0.0	-5.9	-17.1	-34.3
Line of Sight	R O 300 YDS	-1.5	3.3	4.0	0.0	-9.2	-24.4

Velocity, FPS		3000	2821	2649	2483	2323	2169
Energy, Ft-Lb Per Grain		19.98	17.67	15.58	13.69	11.98	10.44
Time of Flight, Seconds		0.0000	0.1031	0.2129	0.3299	0.4548	0.5885
Bullet Path	Z 100 YDS	-1.5	0.0	-2.9	-10.7	-24.2	-44.1
(Inches) +/-	E 200 YDS	-1.5	1.4	0.0	-6.4	-18.4	-36.9
Line of Sight	R O 300 YDS	-1.5	3.6	4.3	0.0	-9.9	-26.3

Velocity, FPS		2900	2725	2556	2394	2237	2086
Energy, Ft-Lb Per Grain		18.67	16.49	14.50	12.72	11.11	9.66
Time of Flight, Seconds		0.0000	0.1067	0.2204	0.3417	0.4713	0.6102
Bullet Path	Z 100 YDS	-1.5	0.0	-3.2	-11.7	-26.3	-47.8
(Inches) +/-	E 200 YDS	-1.5	1.6	0.0	-6.9	-19.9	-39.9
Line of Sight	R O 300 YDS	-1.5	3.9	4.6	0.0	-10.7	-28.3

Velocity, FPS		2800	2629	2464	2304	2151	2004
Energy, Ft-Lb Per Grain		17.41	15.34	13.48	11.79	10.27	8.92
Time of Flight, Seconds		0.0000	0.1106	0.2285	0.3544	0.4891	0.6337
Bullet Path	Z 100 YDS	-1.5	0.0	-3.5	-12.8	-28.6	-52.0
(Inches) +/-	E 200 YDS	-1.5	1.8	0.0	-7.5	-21.6	-43.1
Line of Sight	R O 300 YDS	-1.5	4.3	5.0	0.0	-11.6	-30.6

Velocity, FPS		2700	2532	2371	2215	2065	1921
Energy, Ft-Lb Per Grain		16.18	14.23	12.48	10.89	9.47	8.19
Time of Flight, Seconds		0.0000	0.1147	0.2372	0.3681	0.5084	0.6590
Bullet Path	Z 100 YDS	-1.5	0.0	-3.9	-14.0	-31.3	-56.7
(Inches) +/-	E 200 YDS	-1.5	2.0	0.0	-8.2	-23.4	-46.8
Line of Sight	R O 300 YDS	-1.5	4.7	5.4	0.0	-12.5	-33.2

Velocity, FPS		2600	2436	2278	2125	1979	1839
Energy, Ft-Lb Per Grain		1501	13.17	11.52	10.02	8.69	7.51
Time of Flight, Seconds		0.0000	0.1192	0.2466	0.3829	0.5292	0.6865
Bullet Path	Z 100 YDS	-1.5	0.0	-4.4	-15.4	-34.2	-61.9
(Inches) + /-	E 200 YDS	-1.5	2.2	0.0	-8.9	-25.5	-51.0
Line of Sight	R O 300 YDS	-1.5	5.1	5.9	0.0	-13.6	-36.2

Exterior Ballistic Table for Ballistic Coefficient 0.54

RANGE		MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS		2500	2340	2185	2036	1893	1758
Energy, Ft-Lb Per Grain		13.88	12.16	10.60	9.20	7.96	6.86
Time of Flight, Seconds		0.0000	0.1240	0.2567	0.3990	0.5518	0.7163
Bullet Path	Z 100 YDS	-1.5	0.0	-4.9	-17.0	-37.6	-67.8
(Inches) +/-	E R 200 YDS	-1.5	2.4	0.0	-9.7	-27.8	-55.7
Line of Sight	O 300 YDS	-1.5	5.7	6.5	0.0	-14.9	-39.5
Velocity, FPS		2400	2243	2092	1947	1809	1677
Energy, Ft-Lb Per Grain		12.79	11.17	9.72	8.42	7.27	6.24
Time of Flight, Seconds		0.0000	0.1293	0.2678	0.4164	0.5763	0.7486
Bullet Path	Z 100 YDS	-1.5	0.0	-5.4	-18.8	-41.4	-74.6
(Inches) +/-	E R 200 YDS	-1.5	2.7	0.0	-10.7	-30.5	-61.0
Line of Sight	O 300 YDS	-1.5	6.3	7.1	0.0	-16.3	-43.2
Velocity, FPS		2300	2147	2000	1859	1724	1598
Energy, Ft-Lb Per Grain		11.74	10.23	8.88	7.67	6.60	5.67
Time of Flight, Seconds		0.0000	0.1350	0.2798	0.4355	0.6031	0.7838
Bullet Path	Z 100 YDS	-1.5	0.0	-6.1	-20.8	-45.7	-82.2
(Inches) +/-	E R 200 YDS	-1.5	3.0	0.0	-11.7	-33.6	-67.1
Line of Sight	O 300 YDS	-1.5	6.9	7.8	0.0	-17.9	-47.5
Velocity, FPS		2200	2051	1907	1771	1642	1521
Energy, Ft-Lb Per Grain		10.75	9.34	8.07	6.96	5.99	5.14
Time of Flight, Seconds		0.0000	0.1412	0.2929	0.4562	0.322	0.8221
Bullet Path	Z 100 YDS	-1.5	0.0	-6.8	-23.1	-50.6	-91.0
(Inches) +/-	E R 200 YDS	-1.5	3.4	0.0	-13.0	-37.0	-74.0
Line of Sight	O 300 YDS	-1.5	7.7	8.6	0.0	-19.7	-52.4
Velocity, FPS		2100	1955	1816	1684	1560	1445
Energy, Ft-Lb Per Grain		9.79	8.49	7.32	6.30	5.40	4.64
Time of Flight, Seconds		0.0000	0.1481	0.3073	0.4789	0.6640	0.8639
Bullet Path	Z 100 YDS	-1.5	0.0	-7.6	-25.8	-56 2	-101.0
(Inches) +/-	E R 200 YDS	-1.5	3.8	0.0	-14.4	-41.0	-82.0
Line of Sight	O 300 YDS	-1.5	8 6	9.6	0.0	-21.9	-58.0
Velocity, FPS		2000	1859	1725	1599	1481	1372
Energy, Ft-Lb Per Grain		8.88	7.67	6.61	5.68	4.87	4.18
Time of Flight, Seconds		0.0000	0.1556	0.3231	0.5039	0.6989	0.9095
Bullet Path	Z 100 YDS	-1.5	0.0	-8.6	-28.9	-62.8	-112.6
(Inches) +/-	E R 200 YDS	-1.5	4.3	0.0	-16.0	-45.6	-91.1
Line of Sight	O 300 YDS	-1.5	9.6	10.7	0.0	-24 3	-64.5
Velocity, FPS		1900	1764	1635	1515	1403	1303
Energy, Ft-Lb Per Grain		8.01	6.91	5.93	5.10	4.37	3.77
Time of Flight, Seconds		0.0000	0.1639	0.3406	0.5313	0.7371	0.9592
Bullet Path	Z 100 YDS	-1.5	0.0	-9.7	-32.4	-70.3	-125.9
(Inches) +/-	E R 200 YDS	-1.5	4.8	0.0	-17.9	-50.9	101.7
Line of Sight	O 300 YDS	-1.5	10.8	11.9	0.0	-27.1	-71.9

LONG RANGE TABLES SPEER

100 to 500 yards

Exterior Ballistic Table for Ballistic Coefficient 0.56

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			3100	2923	2753	2589	2431	2279
Energy, Ft-Lb Per Grain			21.33	18.97	16.83	14.88	13.12	11.53
Time of Flight, Seconds			0.0000	0.0997	0.2054	0.3178	0.4374	0.5648
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.6	-9.7	-22.1	-40.3
(Inches) +/-		200 YDS	-1.5	1.3	0.0	-5.9	-16.9	-33.9
Line of Sight		300 YDS	-1.5	3.2	3.9	0.0	-9.1	-24.1
Velocity, FPS			3000	2827	2661	2500	2345	2196
Energy, Ft-Lb Per Grain			19.98	17.74	15.72	13.88	12.21	10.71
Time of Flight, Seconds			0.0000	0.1030	0.2124	0.3287	0.4526	0.5848
Bullet Path	ZERO	100 YDS	-1.5	0.0	-2.9	-10.6	-24.0	-43.6
(Inches) +/-		200 YDS	-1.5	1.4	0.0	-6.3	-18.3	-36.5
Line of Sight		300 YDS	-1.5	3.5	4.2	0.0	-9.8	-25.9
Velocity, FPS			2900	2731	2568	2411	2259	2113
Energy, Ft-Lb Per Grain			18.67	16.56	14.64	12.91	11.33	9.91
Time of Flight, Seconds			0.0000	0.1066	0.2199	0.3405	0.4690	0.6063
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.2	-11.6	-26.0	-47.3
(Inches) +/-		200 YDS	-1.5	1.6	0.0	-6.9	-19.7	-39.4
Line of Sight		300 YDS	-1.5	3.9	4.6	0.0	-10.6	-27.9
Velocity, FPS			2800	2635	2475	2321	2173	2029
Energy, Ft-Lb Per Grain			17.41	15.41	13.60	11.96	10.48	9.14
Time of Flight, Seconds			0.0000	0.1105	0.2279	0.3531	0.4867	0.6296
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.5	-12.7	-28.4	-51.4
(Inches) +/-		200 YDS	-1.5	1.8	0.0	-7.4	-21.3	-42.6
Line of Sight		300 YDS	-1.5	4.2	5.0	0.0	-11.4	-30.2
Velocity, FPS			2700	2538	2382	2231	2086	1946
Energy, Ft-Lb Per Grain			16.18	14.30	12.60	11.05	9.66	8.41
Time of Flight, Seconds			0.0000	0.1146	0.2366	0.3667	0.5058	0.6547
Bullet Path	ZERO	100 YDS	-1.5	0.0	-3.9	-13.9	-31.0	-56.0
(Inches) +/-		200 YDS	-1.5	2.0	0.0	-8.1	-23.2	-46.2
Line of Sight		300 YDS	-1.5	4.6	5.4	0.0	-12.4	-32.8
Velocity, FPS			2600	2442	2289	2141	2000	1864
Energy, Ft-Lb Per Grain			15.01	13.24	11.63	10.18	8.88	7.71
Time of Flight, Seconds			0.0000	0.1191	0.2460	0.3815	0.5265	0.6819
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.3	-15.3	-33.9	-61.2
(Inches) +/-		200 YDS	-1.5	2.2	0.0	-8.8	-25.2	-50.3
Line of Sight		300 YDS	-1.5	5.1	5.9	0.0	-13.5	-35.6
Velocity, FPS			2500	2345	2196	2052	1913	1781
Energy, Ft-Lb Per Grain			13.88	12.21	10.71	9.35	8.12	7.04
Time of Flight, Seconds			0.0000	0.1239	0.2561	0.3975	0.5489	0.7114
Bullet Path	ZERO	100 YDS	-1.5	0.0	-4.8	-16.9	-37.2	-67.0
(Inches) +/-		200 YDS	-1.5	2.4	0.0	-9.6	-27.5	-55.0
Line of Sight		300 YDS	-1.5	5.6	6.4	0.0	-14.7	-38.9

Exterior Ballistic Table for Ballistic Coefficient 0.56

RANGE			MUZZLE	100 YDS	200 YDS	300 YDS	400 YDS	500 YDS
Velocity, FPS			2400	2249	2103	1962	1828	1700
Energy, Ft-Lb Per Grain			12.79	11.23	9.82	8.55	7.42	6.42
Time of Flight, Seconds			0.0000	0.1291	0.2671	0.4148	0.5732	0.7434
Bullet Path	Z	100 YDS	-1.5	0.0	-5.4	-18.6	-40.9	-73.7
(Inches) +/-	E R	200 YDS	-1.5	2.7	0.0	-10.6	-30.2	-60.2
Line of Sight	O	300 YDS	-1.5	6.2	7.0	0.0	-16.1	-42.6
Velocity, FPS			2300	2152	2010	1873	1743	1620
Energy, Ft-Lb Per Grain			11.74	10.28	8.97	7.79	6.74	5.83
Time of Flight, Seconds			0.0000	0.1348	0.2791	0.4337	0.5998	0.7783
Bullet Path	Z	100 YDS	-1.5	0.0	-6.0	-20.7	-45.2	-81.2
(Inches) +/-	E R	200 YDS	-1.5	3.0	0.0	-11.6	-33.2	-66.2
Line of Sight	O	300 YDS	-1.5	6.9	7.8	0.0	-17.7	-46.8
Velocity, FPS			2200	2056	1917	1785	1660	1542
Energy, Ft-Lb Per Grain			10.75	9.38	8.16	7.07	6.12	5.28
Time of Flight, Seconds			0.0000	0.1411	0.2922	0.4544	0.6287	0.8163
Bullet Path	Z	100 YDS	-1.5	0.0	-6.7	-22.9	-50.1	-89.9
(Inches) +/-	E R	200 YDS	-1.5	3.4	0.0	-12.8	-36.6	-73.0
Line of Sight	O	300 YDS	-1.5	7.6	8.6	0.0	-19.5	-51.6
Velocity, FPS			2100	1960	1825	1698	1577	1465
Energy, Ft-Lb Per Grain			9.79	8.53	7.39	6.40	5.52	4.76
Time of Flight, Seconds			0.0000	0.1479	0.3065	0.4769	0.6603	0.8577
Bullet Path	Z	100 YDS	-1.5	0.0	-7.6	-25.6	-55.7	-99.8
(Inches) +/-	E R	200 YDS	-1.5	3.8	0.0	-14.2	-40.5	-80.8
Line of Sight	O	300 YDS	-1.5	8.5	9.5	0.0	-21.6	-57.1
Velocity, FPS			2000	1864	1734	1612	1497	1391
Energy, Ft-Lb Per Grain			8.88	7.71	6.68	5.77	4.98	4.30
Time of Flight, Seconds			0.0000	0.1554	0.3223	0.5017	0.6949	0.9029
Bullet Path	Z	100 YDS	-1.5	0.0	-8 5	-28.6	-62.1	-111.2
(Inches) +/-	E R	200 YDS	-1.5	4.3	0.0	-15.8	-45.1	-89.9
Line of Sight	O	300 YDS	-1.5	9.5	10.6	0.0	-24.0	-63.5
Velocity, FPS			1900	1768	1644	1527	1419	1320
Energy, Ft-Lb Per Grain			8.01	6.94	6.00	5.18	4.47	3.87
Time of Flight, Seconds			0.0000	0.1637	0.3396	0.5290	0.7329	0.9523
Bullet Path	Z	100 YDS	-1.5	0.0	-9 6	-32.1	-69.6	-124.3
(Inches) +/-	E R	200 YDS	-1.5	4.8	0.0	-17.7	-50.3	-100.3
Line of Sight	O	300 YDS	-1.5	10.7	11 8	0.0	-26.7	-70.8
Velocity, FPS			1800	1674	1555	1444	1343	1252
Energy, Ft-Lb Per Grain			7.19	6.22	5.37	4.63	4.00	3.48
Time of Flight, Seconds			0.0000	0.1729	0.3589	0.5591	0.7746	1.0062
Bullet Path	Z	100 YDS	-1.5	0.0	-10.9	-36.3	-78.3	-139.6
(Inches) +/-	E R	200 YDS	-1.5	5.5	0.0	-19.9	-56.4	-112.3
Line of Sight	O	300 YDS	-1.5	12.1	13.2	0.0	-29.9	-79.2

VARIATION OF MUZZLE VELOCITY WITH POWDER TEMPERATURE

These data were not obtained from high velocity firings of rifle cartridges, but, rather, indicate what may be expected from progressive burning smokeless powder with normal density. They are, however, in approximate agreement with scattered and meager data available for rifle cartridges. Cartridges with very high loading density and high chamber pressures may vary quite considerably, with respect to temperature changes, from the values shown below. It should be remembered that even carefully loaded cartridges fired at constant temperature will show variations in muzzle velocities of from 10 to 80 f/s from one shot to the next. This table will serve, however, to indicate the direction and approximate magnitude of the effect of temperature changes.

Temperature Degrees Fahrenheit

0°	**10°**	**20°**	**30°**	**40°**	**50°**	**60°**	**70°**	**80°**	**90°**	**100°**
2631	2641	2648	2657	2668	2682	2700	2722	2750	2784	2827
2733	2738	2746	2755	2767	2782	2800	2823	2851	2887	2931
2830	2836	2846	2854	2866	2881	2900	2924	2953	2990	3036
2928	2934	2942	2952	2965	2981	3000	3025	3055	3093	3141
3025	3032	3040	3051	3064	3080	3100	3125	3157	3196	3246
3127	3130	3138	3149	3163	3179	3200	3226	3258	3299	3350
3221	3228	3236	3248	3261	3279	3300	3327	3360	3402	3453
3318	3325	3334	3346	3360	3378	3400	3428	3462	3505	3560
3416	3423	3433	3444	3459	3477	3500	3529	3564	3608	3664
3514	3521	3531	3543	3558	3577	3600	3629	3666	3711	3769
3611	3619	3629	3641	3657	3676	3700	3730	3768	3814	3874
3709	3717	3727	3740	3756	3775	3800	3831	3870	3918	3978
3806	3814	3825	3838	3854	3875	3900	3932	3971	4021	4083
3904	3912	3923	3936	3953	3974	4000	4033	4073	4124	4188
4001	4010	4021	4035	4052	4073	4100	4133	4173	4227	4292
4099	4108	4119	4133	4151	4173	4200	4234	4277	4330	4398

GLOSSARY OF RELOADING & SHOOTING TERMS

Accuracy: The measure of precision in consistently obtaining a desired result. In shooting, the measure of a bullet's or gun's ability to place all shots close to the same point.

Action: The mechanism of a firearm by which it is loaded, locked, fired and unloaded.

Air Resistance: The slowing effect of air on a projectile in flight.

Annealing: In handloading, the heating of brass after work-hardening to prevent it from becoming too brittle. Only the neck should be annealed and great care should be taken not to overheat and thus soften the head and rear portion of the case. *See Work-harden.*

Antimony: A metallic element which increases the hardness of lead when combined as an alloy.

Anvil: In the priming system, a fixed metallic point against which the priming mixture is crushed and thereby detonated by the action of the firing pin.

Ball: Early term for "bullet." Still used in military nomenclature, usually to describe a full-metal jacketed bullet.

Ball Powder: Trademarked name for a double-base smokeless propellant powder developed by Olin, Inc. Either spherical or flattened spherical shape.

Ballistics: The science of projectiles in motion. Divided into *interior ballistics*— covering the time between the start of primer ignition and the bullet's exit from the barrel; *exterior ballistics*—the bullet's movement from barrel exit to target impact; and *terminal ballistics* —the bullet's behavior from the moment it enters its target until it stops.

Ballistic Coefficient: Ratio of the sectional density of a bullet to its coefficient of form. Represents the projectile's ability to overcome the resistance of the air in flight.

Barrel-cylinder Gap: The clearance between barrel and cylinder in a revolver.

Battery Cup: Type of primer in which anvil and primer cup are supported in an outside cup. Shotshell primers are of this type.

Bearing Surface: That portion of a bullet's surface that actually touches the bore in moving through the barrel.

Bedding: Manner in which the barrel and action of a rifle is fitted to the stock.

Bell: To expand the mouth of a case slightly in order to seat a bullet more easily. Also called *flare.*

Belted Case: Case head type with raised band or belt at the base ahead of extractor groove. A variant of the *rimless* case. Belt acts to control headspace of the cartridge. See *rim* and *rimless.*

Berdan: Type of primer with no integral anvil. Anvil is formed in bottom of primer pocket in the case. Common in Europe. Named after the inventor, Col. Hiram Berdan, an American.

Bench Rest: A solid table or bench used for supporting a gun when testing for accuracy. Bench Rest target shooting has become an important shooting sport where the smallest group wins.

Black Powder: The oldest ballistic propellant for muzzle loaders and early cartridge arms composed of a mixture of potassium nitrate (saltpeter), charcoal and sulfur.

Boat Tail: Name given to a bullet type with tapered base. Also "taper heel".

Body (of a case): That section of a cartridge case between the head and the shoulder that contains the powder.

Bolt: The locking and cartridge-supporting mechanism of a firearm that operates in line with the axis of the bore. It contains the firing pin, firing pin spring, extractor(s) and sometimes the ejector.

Bolt Thrust: The force on the face of the bolt or breech of a firearm caused by the pressure of burning powder gases. Bolt thrust acts on an axis parallel to the bore.

Bore: The inside of the barrel of a gun of any kind and, in rifled arms, the diameter of the barrel before the rifling is cut.

Bore Sight: To align the sights of the firearm with a target by sighting through the bore.

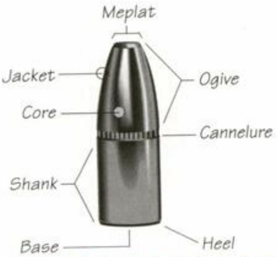
Boxer: The standard American type of primer, named after the inventor of this type of primer, Col. Edward Boxer of the British Army. See *Primer.*

Brass: An alloy of copper and zinc of which cartridge cases are usually made. This term is often applied to empty cartridge cases. Typical cartridge brass has a copper/zinc ratio of 70/30.

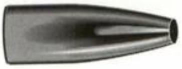
Brisance: The characteristic in an explosive of brusqueness or shattering power. The more brisant an explosive, the more rapidly it detonates and the greater its relative power.

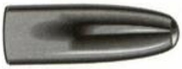
Bullet: The missile only. Becomes a projectile when in flight. Not to be applied to the term *cartridge.* *See also ball.*

Parts of a Bullet



Bullet Types


Hollow Point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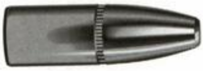
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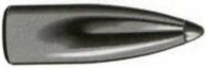
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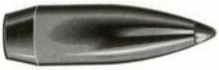
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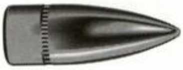
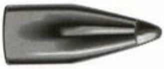

Full Metal Jacket (FMJ)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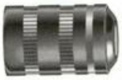
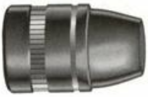

Wadcutter


Semi-Wadcutter

Bullet Path: The track followed by a bullet in flight. It is described by the location of the projectile above (+) or below (–) the line-of-sight at a given range.

Bullet Pull: The amount of force needed to extract a bullet from a loaded cartridge. Used by ammunition manufacturers to measure uniformity of crimp.

Bullet Puller: A tool for extracting bullets from loaded cartridges. The *inertial* and *collet* types are most common.

Burning Rate: A relative term used to rank the rapidity with which a given powder releases in comparison with other powders.

Caliber: A term that derives from Latin *qua libra,* meaning "what pound," first applied to the weight of a bullet and then to the diameter. Caliber now refers to the diameter of either a projectile or the bore of a gun. It is the approximate bore or groove diameter expressed (in English) in hundredths of an inch. A bullet that is 0.451" in diameter is 45 caliber. To write ".30 caliber" is technically incorrect. According to the strict definition, such a bullet would only be 0.003" in diameter! Frequently compounded with other descriptive words or numbers to create a cartridge name, e.g., 308 Winchester or 30-40 Krag.

Also used in artillery as a measure of length equal to the diameter (or caliber) of a specified gun, as, a "fifty caliber" barrel would be 50 bore diameters long. A "6 caliber" bullet ogive would have a radius of 6 bore diameters.

Cannelure: Circumferential groove(s) around a bullet or cartridge case. Used for identification, to hold lubricant, or to crimp case into.

Canister Powder: Since handloaders do not have the laboratory facilities needed to determine the loading characteristics of a powder, the powder manufacturers have developed a rigid set of specifications for each handloader powder they sell. Each lot of powder is made or blended to meet these specifications so the handloader will always have uniform results. Powder made to these specifications is termed "Canister" grade since it is usually packed in containers of suitable size for consumer use.

Commercial ammunition manufacturers that have laboratory facilities can use the "bulk" grades, which may vary enough from lot to lot to be dangerous to handloaders. Loads are adjusted for each powder lot as required.

Cap: See *primer.*

Cartridge: A complete unit of assembled ammunition: case, propellant powder, primer, and bullet. Commonly applied only to rifle and pistol ammunition, but occasionally to shotshells.

Case: The paper, metal, or plastic container which holds all the other components of a cartridge. Sometimes called *hull* or *shell.*

Case Forming: To alter or modify one cartridge case to another of diferent shape and/or caliber. Also see *wildcat.*

Case Hardening: A heat treating process which increases the surface hardness of iron alloys. Often produces distinctive colors, such as seen on the frames of Colt Single Action revolvers.

Case Trimming: Shortening an overly long case by removing metal at the case mouth.

Cast Bullet: Bullets for rifles or pistols cast from lead or lead alloy in a mould. See *mould blocks*

Center Fire (CF): Refers to centrally located primer in base of metallic cartridges. Also called *centerfire.* Most center fire cartridges are reloadable.

Chamber: That part of the bore, at the breech, formed to accept and support the cartridge. In a revolver, chambers are located in the *cylinder.*

Chamber Cast: A casting, usually of sulfur or low melting-point metal, poured in the chamber to more easily measure chamber shape or condition.

Chamfer: To bevel or ream a taper on the inside of a case mouth to facilitate bullet seating.

Charge: The amount of propellant powder measured into the case in loading. Also refers to amount of shot measured into shotshell.

Choke: A constriction at the muzzle of a shotgun barrel designed to control the spread, or dispersion, of the shot charge.

Chronograph: An mechanical or electronic device used to measure the velocity of a projectile.

Collimator: In shooting, an optical device used to align telescopic sights with the bore of a rifle or handgun.

Combustion: Burning; in firearms, the chemical process which unites oxygen and other substances in gun powder to produce heat and gas. Also called *deflagration*.

Compensator: A device fitted to the muzzle of a firearm to reduce recoil or muzzle rotation. Usually applied to such devices when fitted to a handgun. See *muzzle brake*.

Compressed Charge: A charge of powder which is compressed by the bullet during seating in the case.

Components: The parts which go into the making of a cartridge.

Copper Crusher: Small, solid copper cylinder used in a pressure gun to measure chamber pressure. See *pressure gun*.

Core: The interior part of a jacketed bullet; usually a lead alloy in sporting ammunition.

Cordite: Trade name for a long, tubular-grained, double-base powder used mainly in Great Britain, and one of the earliest smokeless propellants. The granules are often as long as the powder space.

Corrosion: The eating away of the bore because of rusting or the chemical action of salts deposited in the bore by corrosive primers or powders. See below. Cartridge cases can also be corroded by salts or acids.

Corrosive Primer: A primer whose burnt residue is hygroscopic (attracts moisture). The moisture will rapidly rust a bore unless removed. All component primers in the U.S. have been non-corrosive for decades

Crimp: The bending inward of the mouth of the case in order to grip the bullet, or to close the mouth of a shotshell case. Two types are used. A *roll crimp* is the bending or rolling the mouth of the case into the crimp groove or cannelure of the bullet. In a *taper crimp*, the mouth of the case is pressed into the bullet body without bending the case mouth.

Crimped Primer: A forcing inward of the brass around the top of the primer pocket to prevent setback of primers. This is usually found on military cartridges intended for use in fully automatic weapons. Unless the crimp is removed after depriming—either by swaging or reaming—repriming of the case is very difficult.

Cupro-Nickel: A copper-nickel alloy once used extensively for bullet jackets. It was largely replaced by *gilding metal* because of barrel fouling problems.

Deburr: To remove burrs or roughness sometimes left on case mouth edge by trimming operation. See *chamfer*.

Decap or Deprime: To remove or eject a primer from its primer pocket. Usually done by the *decapping pin* in the sizing or expanding operation.

Deterrent Coating: A chemical coating applied over powder kernels to control the burning characteristics of the base powder. Aptly described as a "temporary fireproofing" of a powder kernel.

Die: In handloading, a tool to form or reform cases or bullets, or to seat bullets.

Double-base Powder: Nitrocellulose (smokeless) propellant that uses nitroglycerine as the *plastisizer*.

Drag: See *air resistance*

Dram Equivalent: In shotshells, a term used to indicate that a charge of smokeless powder produces the same velocity as a given number of drams of black powder. Thus, a 3 dram equivalent load has a charge of smokeless powder that gives the same velocity as a similar load charged with 3 drams of black powder. One dram equals 27.3 grains.

Drift: In exterior ballistics, the deviation of a projectile from the line of departure due to its rotation or spin. Also commonly applied to the effects of wind. See *wind deflection.*

Drop: The distance a projectile falls due to gravity, measured or calculated from the line of departure. Must be corrected for difference between line of sight and line of departure. Drop is normally reported assuming a horizontal barrel.

Duplex Load: Use of two different powders in loading the same cartridge. There is little or no advantage to duplex loading in small arms and results are unpredictably dangerous.

Elevation: The vertical adjustment of a sight to bring the point of aim into coincidence with the point of impact.

Energy: The amount of work capable of being done by a projectile at a given range, expressed in foot-pounds in the English system. Found by multiplying the square of the velocity in feet/sec by the weight of the bullet in grains and dividing by 450,400.

Engraving: The marks made on the bullet by the rifling.

Erosion: The wearing away of the bore of a firearm due to friction from the projectile or the action of hot powder gases.

Expander Ball or Button: The round steel part of a die that expands the sized neck of a cartridge case to the diameter needed to hold the bullet firmly.

Expansion Ratio: Ratio of interior case volume to bore volume.

Extruded Primer: A primer that on firing has the metal of the primer cup forced back into the firing pin hole in the face of the bolt. Also known as *cratering*. Usually a gun problem, not a pressure sign.

Extrusion: The shaping process used in the manufacture of bullet jackets and cores.

Extruded Tubular Powder: Another term for *cylindrical powder*. Formed by forcing damp propellant mix through a die during manufacture and cutting to desired lengths. Usually has one or more longitudinal holes through the grains.

FPS: Feet per second, a measure of velocity in the English system. Also feet/sec, ft/sec, or fs.

Fireform: Using the pressure of normal firing to shape a cartridge case to fit a given chamber.

Firing Pin: That part of a gun's mechanism that strikes the primer to start ignition.

Flake Powder: A smokeless powder characterized by thin, disc-shaped granules.

Flash Hole: The hole leading from the primer pocket into the body of the cartridge case. Also called the *vent.*

Foot-pound: A unit of kinetic energy in the English system defined as the effort required to raise one pound to a height of one foot against the force of gravity.

Forcing Cone: The slope of the forward end of the chamber of a rifle or shotgun which decreases the chamber diameter to bore diameter. In a revolver, the bevel in the rear of the barrel just ahead of the cylinder.

Form Factor: A multiplier which relates the shape of a bullet to the shape of the standard projectile used to determine the *ballistic coefficient.*

Freebore: The distance, if any, which a bullet travels upon firing before it contacts the rear portion or origin of the rifling.

Frontal Ignition: Experimental type of cartridge where primer flash is directed to the forward part of the powder charge through a metal tube.

FMJ: Full metal jacket. See *metal case.*

Galling: Friction between a case and sizing die producing roughness on the case and case metal deposited on the die surface.

Gas: In handloading, the vapor produced by burning powder. This heavy gas is capable of expanding rapidly, creating sufficient pressure to propel the bullet at high speed.

Gas Check: A copper or brass cup used to prevent hot, high-pressure powder gases from deforming the base of lead bullets.

Gilding Metal: A copper-zinc alloy used for bullet jackets. Usually 5% to 10% zinc with the remainder being copper.

Grain: In English weight measure, 7000 grains equal one pound; 437.5 grains equal one ounce. Incorrectly used in referring to a particle, or kernel, of powder. Thus "35 grains of powder" always refers to 35 of the weight-unit grains, never to 35 individual kernels of powder.

Grand Slam: An honorary award to a hunter who has collected the four varieties of North American wild sheep. Also the trademark of the premium hunting bullet made by Speer.

Granulation: Refers to powder grain size and type. Can apply to either black or smokeless powder.

Grease Groove: Lubricating groove. On a lead bullet, a circumferential groove used to hold lubricant.

Grooves: Spiral cuts or impressions in the bore of a firearm which cause a bullet to spin as it moves through the barrel. See *rifling*.

Group: The pattern made at the target by a number of shots fired with one aiming point and usually one sight setting. Usually measured from center to center of the holes farthest from each other.

Gun Powder: Propellant explosive used in small arms. Can be either smokeless or black powder.

Half-jacket: A short jacket or a bullet swaged with a short jacket, which leaves some lead in contact with the bore. A three-quarter jacket is similar but longer, so the bearing surface of the bullet is covered by the jacket material.

Handloading: The practice of loading or reloading small arms ammunition by hand-powered equipment and methods.

Hangfire: Slang term for a *delayed firing*, which is any detectable delay in the ignition of a cartridge after pulling the trigger. Can be a *chemical* delay caused by the cartridge or a *mechanical* delay caused by a defect in the firearm. Chemical delays are recognized as being less that 0.3 seconds. The use of modern lead styphnate priming has virtually eliminated the chemical delay. Chemical delays were more common with the now obsolete potassium chlorate priming compounds.

Headspace: The distance from that surface of the barrel or chamber that prevents the cartridge from moving further forward into the chamber, to the face of the breech with the action fully closed and locked. This is the most important dimension governing the safety of the shooter. In handloading, the combination of cartridge case and gun must be considered when talking of headspace. To a handloader, few guns need to have excessive headspace, since he can adjust the cartridge case to fit the chamber, even though the chamber may have excessive headspace when measured by SAAMI standards.

Heel: The edge of the bullet base.

Holdover: The distance above target a shooter must "holdover" to hit at ranges greater than the gun's "zero." See *zero*.

Hollow Point (HP): Bullet design feature; an axial hole at point of bullet.

Hot-Cor: The registered trademark for Speer's exclusive process of manufacturing flat-base rifle bullets. A molten core is poured into a clinically clean jacket and then the bullet is immediately swaged to shape, with a resulting tight bond between core and jacket.

Hydrostatic Shock: A pressure wave created by a bullet passing through animal tissue, which is high in water content.

Ignition: The setting on fire of the propellant powder charge by the primer.

IHMSA: International Handgun Metallic Silhouette Association.

Improved: Term used to indicate a standard cartridge case which has been altered by fireforming to reduce body taper and/or increase shoulder angle. Improved cases have greater powder capacity than the corresponding standard case.

IMR: Abbreviation for "Improved Military Rifle," a trademark of DuPont (now IMR Powder Co.) to its line of single-base rifle powders.

Ingalls' Tables: Ballistic tables computed by Col. James M. Ingalls and first published in 1918. The most widely used ballistic tables in the U.S. The ballistic coefficients of Speer bullets are determined from Ingall's tables.

IPSC: International Practical Shooting Confedration.

Jacket: The cover or "skin" of a bullet. Usually made of gilding metal in the U.S., but copper-clad steel or mild steel are also used in other countries. See *cupro-nickel* and *half-jacket*.

K (used as a prefix): Applied to cartridge case improvements developed by experimenter Lysle Kilbourn. Example: the 22 K-Hornet.

Keyhole: The imprint of a bullet on a target that shows that the bullet was not traveling point-on at the time of impact.

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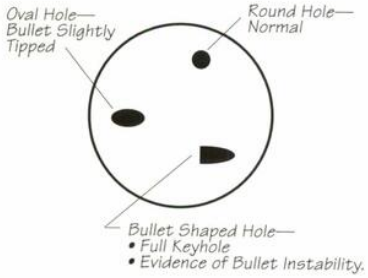
Bullet Holes In Paper



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Lands: The spiraling raised portion of a bore remaining after the grooves have been cut or formed.

Lead Crusher: A pure lead cylinder used in a pressure gun for obtaining *lead units of pressure* (L.U.P. or lup). Formerly used to test low-pressure cartridges such as shotshells, this system is now obsolete in the United States.

Leade: See *throat* or *freebore*.

Leading: Lead deposited in the bore from the friction of lead bullets rubbing against the bore, or from gas-cutting of lead bullets. A form of metal fouling, some leading is normal; however, excess leading can destroy accuracy and raise pressures.

Line of Departure: The line at which a bullet leaves the muzzle of a firearm, equivalent to the axis of the bore. The bullet immediately falls away from this imaginary line.

Line of Sight (LOS): The straight line through the sights of a gun to the point of aim.

Loading Block: A block of material, usually wood or plastic, with rows of holes to conveniently hold a number of cartridge cases during the loading operation. Especially useful when charging cases with a powder measure.

Loading Density: Ratio of the volume of powder charge to the volume of the case.

Locking Lugs: Protrusions on the bolt which engage a mating recess inside the receiver ring when the bolt is closed. This feature prevents the bolt from moving rearward when the rifle is fired. Usually used in reference to rotary bolt-action firearms.

Lock Time: The period of time between the release of the sear by trigger movement and the instant the priming mixture detonates after being hit by the firing pin.

Lubricant: Case sizing lubricant is used to reduce friction when sizing cartridge cases. Bullet lubricant is used to help minimize leading when firing lead alloy bullets.

Lubricator-Sizer: A tool used to size and lubricate cast lead bullets. Often contracted to *lubrisizer*.

Magnum: Originally, a large wine bottle. In shooting, it refers to a cartridge of exceptional size or power. First applied to large bottleneck cartridges, hence the name. *Magnum* is more of a marketing term than a technical one.

Mean Radius (MR): The average radius of a group of shots from the center of the group. Another method of recording accuracy, MR is commonly seen in military contract specifications for accuracy. *Extreme spread* is more commonly used to measure accuracy in commercial ammo manufacturing and hobby shooting.

Meplat: The diameter of the flat or blunt end of the nose of a bullet.

Mercuric Primer: A primer in which the primary initiator is mercury fulminate. These primers have been obsolete since the advent of metallic cartridge reloading over a century ago. On firing, the compounds release minute amounts of metallic mercury. Mercury attacks the cartridge case making it brittle and thus unsuitable for further loading.

Metal Case (MC): Also Full Patched (FP) or Full Metal Jacketed (FMJ). A type of bullet in which the core is completely encased in jacket material, except for an opening on the base. Standard military bullet type.

Metal Fouling: Bullet jacket material deposited in bore due to friction. More common in very high-velocity rifle cartridge, metal fouling must be removed to prevent corrosion due to the electrolytic action of the copper against the steel barrel. Metal fouling can also result from a rough bore at any velocity.

Micrometer: A measuring instrument with a fine screw adjustment for measuring very small distances. Usually calibrated to read in increments of 0.001" or 0.0001".

Mid-range Trajectory (MRT): Usually refers to the highest vertical distance of a bullet above the line of sight at a point approximately halfway from muzzle to target or point of aim. The MRT varies with the zero range for a given load. Also called the *maximum ordinate*.

Minute-of-angle (MOA): A unit of angular measurement equal to 1/60th of a degree. Although usually approximated as one inch per 100 yards, it is actually equal to 1.047" per 100 yards.

Misfire: Complete failure of a cartridge to discharge after the primer is struck by the firing pin.

Mould Blocks: Two "mirror twin" pieces of metal having a bullet-shaped cavity in which lead bullets are cast.

Mushroom: The ability or capacity of a bullet to increase its diameter upon impact with animal tissue. The name comes from the desired shape after expansion.

Muzzle: The front end of a barrel. The point at which a projectile leaves the barrel.

Muzzle Blast: The effect of hot, high-pressure powder gases jetting from the muzzle of a gun.

Muzzle Brake: A deflector fitted to a gun muzzle to deflect exiting gases. Usually used to reduce recoil by redirecting the jet effect of muzzle blast. Also called a *recoil compensator*, or *comp* for short. See *compensator*.

Muzzle Energy (ME): The energy of a bullet at the muzzle. At this point a bullet's energy is highest. See *energy*.

Muzzle Pressure: Gas pressure in the barrel at the muzzle at the instant the bullet leaves the muzzle.

Muzzle Velocity (MV): See *velocity*.

NBRSA: National Bench Rest Shooters Association.

Neck: That portion of a cartridge case which grips the bullet. In a bottlenecked case, that portion of the case in front of the shoulder.

Neck Down or Up: To change the diameter of the case neck during case forming.

Neck Expansion: The act of expanding a sized case neck by pulling it over an expander plug or button.

Neck Ream: Reducing neck wall thickness from the inside with a reamer. Commonly performed when forming a short case from a much longer one, such as the 300 H&H to 6.5mm Remington Magnum conversion.

Neck Size: To resize part or all of the neck only, leaving the case body unchanged.

Neck Turn: Reducing neck wall thickness from the outside by cutting or grinding.

Non-corrosive: Cartridges or primers with priming mixture that does not contain any compound capable of causing rusting or corrosion of bore or adjacent parts. All commercial small arms primers made in the U.S. and most military ammunition produced since 1954 has non-corrosive primers, although it is well to clean the bore promptly when in doubt.

Non-mercuric: A priming mixture containing no mercury compounds.

NRA: National Rifle Association. If you haven't joined yet, don't put it off!

NRMA: National Reloading Manufacturers' Association.

NSSF: National Shooting Sports Foundation.

Ogive: The curved portion of a bullet ahead of the cylindrical, or shank, section. Also, the radius of this curve, usually expressed in calibers.

Oil Dent: Dent in cartridge case formed by too much oil or lubricant when sizing. Usually seen on the shoulder.

Overbore Capacity: A common but unscientific term referring to a cartridge case that has too much case volume for its bore volume. Technically, every case can be over its bore capacity with some powder. Generally used when a case has a volume so large in relation to the bore diameter that only the very slow burning powders will give satisfactory performance.

Parallax: In telescopic sights, the condition that exists when the reticle (crosshairs) does not lie exactly on the image plane. Excessive parallax makes the shooter's eye position very critical is repeatable accuracy is to be obtained. Most lower power scope have the parallax pre-set at 150 yards; high-magnification scopes (10X and up) commonly have an adjustable objective to correct for parallax at various distances.

Patched or Paper-patched Bullet: A bullet with a wrapped paper "patch" commonly used in older black powder cartridges. Derived from the even older cloth patch used to wrap a muzzle-loader ball. The patch helped seal the powder gases and reduced bore leading, and was an evolutionary step towards today's metal bullet jackets.

Pattern: The way a shotgun places its shot load. Generally measured as the percentage of pellets that strike in a 30" circle at 40 yards. Has been jokingly used to describe a very poor rifle group.

Pierced Primer: A primer that has been punctured; caused by a defective firing pin, a weak firing pin spring or excessive clearance between the firing pin and breech.

Plinking: Informal target practice commonly at informal targets. Shooting for fun where no one keeps score.

Point of Aim: That point on which a gun's sights are aligned; the intended spot where the shooter wants his bullet to strike.

Port Pressure: In a gas-operated firearm, the pressure measured at the gas port leading to the piston assembly.

Powder: The propellant material used in most gun systems. Divided into two basic types: *smokeless powder* and *black powder*. It is produced in a wide variety of types, forms and brand names intended for specific applications. It varies chiefly according to burning speed. The fast-burning types are used for light bullets in short barrels at low velocities: slower-burning powders are used in longer barrels and in greater quantities to drive the bullet at higher velocities. Most powder contains a major percentage of nitrocellulose, with small traces of other compounds intended to control burning rate or prevent deterioration; such powder is called *single-base*; smokeless powders containing a percentage of nitroglycerine are called *double-base*. Powders containing substantial amounts of other organic nitrates are called *multi-base*. Further identified by shape of individual kernels or granules. See *ball powder*, *flake powder* and *extruded tubular powder*.

Black powder is a mechanical mixture of sulfur, charcoal, and saltpeter. It is now used primarily in muzzle-loading guns.

Powder Bridging: A condition that may occur in the drop tube of a powder measure. The powder kernels interlock and wedge together to block free passage. A "log jam" of powder. Most common with long, cylindrical powder kernels. Can be compared to an arch construction in a bridge.

Powder Measure: A mechanical device to meter powder charges by volume. Used to speed the charging process.

Powder Scale: A sensitive measuring device used to accurately weigh small charges of powder. Designed expressly for cartridge reloading, it is usually graduated to permit weighing to units as small as 1/10th grain.

Powder Trickler: A mechanical accessory that dribbles a few powder granules at a time, used with a powder scale.

Pressure: The pressure exerted by a burning charge of powder in the chamber of a gun. Expressed normally as the peak pressure in pounds per square inch (psi) or copper units of pressure (cup) depending on the test equipment.

Pressure Gun: Device for measuring chamber pressure generated by a cartridge. Usually of the "crusher" type or of the electronic "transducer" type. Both types were used in the development of the Speer Reloading Manual.

Pressure-Velocity Ratio: Numerical comparison of velocity to pressure in a specific cartridge with given bullet and powder.

Primer: Also called "cap", deriving from the percussion caps used with some muzzle-loading arms. In a centerfire cartridge, the small metal cup contains a detonating mixture which is used to ignite the propellant powder. The primer is seated in the primer pocket in the base of the cartridge case. The standard American type of primer, the "Boxer," also contains an anvil. Electrically fired primers are used in some military weapons and in some experimental European sporting arms. In a rimfire cartridge the priming mixture is contained within the rim of the case. See *anvil*, *berdan*, and *battery cup*.

Primer Flipper: A two-piece metal or plastic tray for orienting and turning primers. Facilitates loading of primer tubes in semi-automated equipment.

Primer Indent: Depression made in primer by firing pin. Also called the *firing pin impression*.

Primer Leak: When high-pressure gas forces out between primer and primer pocket wall. Usually indicates a damaged primer pocket.

Primer Pocket: The cavity in the base of a centerfire cartridge case made to receive and support the primer.

Primer Pocket Reaming or Swaging: Two methods for removing the primer pocket crimp from military cases.

Primer Punch: A tool part which inserts the primer.

Primer Tool: A specialized tool which does only the priming operation. Usually used in reference to off-press priming.

Progressive: Characteristic of a powder which burns at a predictable rate compared to black powder, producing a relatively slow pressure build-up.

Projectile: A bullet or any other object projected by force and continuing in motion by its own inertia. Note: A bullet is not a projectile until it is in motion.

Proof Cartridge: A special cartridge used to test a new or repaired firearm for strength and safety. Usually about 25% higher pressure than normal maximum pressure. Not commercially available.

Propellant: The technically correct term for ballistic chemicals used to propel a projectile. See *powder*.

Protruding Primer: A primer which partially backs out of the primer pocket on firing. Usually an indication of low firing pressure.

Pyrodex®: A recently developed black powder replacement designed primarily for use in percussion muzzle loading arms, black powder cartridges and muzzle loading cannon. Manufactured and distributed exclusively by Hodgdon Powder Co.

Ram: The main plunger or shaft of a metallic ammunition reloading tool.

Range: 1. A place where shooting is conducted. 2. The horizontal distance of travel of a projectile from gun to target.

Ream: To remove metal from a cavity with a rotary cutting tool.

Rebated Rim: In cartridge case design, a case whose rim is smaller than the body. Examples: 284 Winchester and 41 Action Express.

Recoil: The backward thrust or "kick" of a gun caused by the powder gases pushing the bullet through the bore and the jet effect of the gases themselves.

Recoil Buffer: A cushioning device to help reduce action battering; most commonly used in semi-automatic firearms.

Reloading Press: A tool used in reloading ammunition. Usually has some form of mechanical advantage to reduce effort in resizing or reforming cases. Available in several basic types known by the shape of letters of the alphabet; "O" types are most common today, but "H" and "C" types have been used also.

Remaining Energy: The residual or "down-range" energy of a projectile, measured in foot pounds, at a given distance from the muzzle.

Remaining Velocity: The residual speed of a projectile at a given point on its trajectory.

Reticle: The aiming indicator at the focus of a telescopic sight. May consist of straight or tapered lines (crosshairs), dots, posts, or some combination thereof. Some scopes have auxiliary marks for range estimation.

Rifling: Spiral grooves cut or impressed into the bore of rifles and pistols in order to make the bullets spin, insuring stable flight to the target. See *grooves* and *lands*.

Rim: The feature at the base of most cartridge cases in which the extractor engages to pull a fired cartridge from the chamber. In England this is called the *flange*. See *rimless* and *rimmed*.

Rimfire (RF): Cartridges which contain the priming mixture within the rim. This type is not reloadable under any practical conditions.

Rimless: A case head type; actually a misnomer. Rimless cases have a rim, but it is the same diameter as the case body so it does not protrude. An undercut *extraction cannelure* or groove provide a surface for the extractor to grip. Example: 30-06 Springfield

Rimmed: A case head type whose rim protrudes beyond the case body. Example: 30-30 Winchester.

Round: A military term meaning one complete cartridge.

Round Nose: Bullet design feature; a blunt, spherical nose shape.

Rupture: Also *separation*. In shooting, a failure or break in the wall of a cartridge case, usually allowing gas to escape.

SAAMI: Small Arms and Ammunition Manufacturers Institute. The organization which establishes firearms standards in the United States.

Sabot: From French for "shoe". In modern small arms usage, a lightweight carrier or "shoe" in which a sub-caliber projectile is centered to permit firing the bullet in a larger caliber barrel. Sabots are usually the discarding type; they fall away from the bullet soon after exiting the gun barrel. Pronounced "say-bo."

Seating Depth: In a loaded cartridge, the depth to which the base of the bullet is seated below the case mouth.

Sectional Density: A bullet's weight in pounds divided by the square of its diameter in inches.

Shank: The cylindrical section of a bullet below the ogive. The shank usually defines the bearing surface.

Shell Holder: The part of a reloading press that holds the head of the cartridge case on the ram.

Shock: See *hydrostatic shock*.

Shock Wave: The compression wave formed whenever the speed of a projectile relative to air or other medium exceeds that at which the medium can transmit sound.

Shot: The lead alloy spheres, sometimes copper or nickel-plated, which are used for the projectiles in shotguns. *Chilled* shot is hardened. *Drop* shot is very soft.

Shoulder: The sloping or rounded part of a bottleneck cartridge case between the neck and the body.

Sighting in: Firing a rifle or pistol to determine its point of impact at a specified range and adjusting the sights so the point of impact has the desired location with regard to the point of aim.

Single-base Powder: Nitrocellulose powder made without the addition of any other highly nitrated chemical such as nitroglycerine. See *double-base powder*.

Sizing: Also *resizing*. Reducing a fired cartridge case to dimensions that allow easy chambering in a firearm of the appropriate caliber. May be full length, partial, or neck sizing. Bullets are also sized or reduced in diameter by forcing through a die.

Slug: A large, single projectile, often bearing external pre-cut rifling, intended for adapting shotguns to the hunting of larger game such as deer. Also a slang term for *bullet*. As a verb, "to slug" means forcing a soft lead slug through the bore of a gun and measuring it to determine barrel dimensions.

Smokeless Powder: A nitrocellulose-based propellant. Leaves a non-corrosive residue, but normally produce small amounts of smoke. Named because smoke production is very small compared to the older black powder.

Soft point (SP): Bullet design feature in which a portion of the lead alloy core is exposed at the tip of a jacketed bullet.

Spent: In shooting, a cartridge or component thereof which has been fired.

Spherical Powder: A registered trademark of Hodgdon Powder Company use to describe round or semi-round grained powders. See *ball powder*.

Spin: The rapid rotation of the projectile caused by the spiral rifling of the bore. At the muzzle of a high-velocity rifle, spin can be in excess of 300,000 revolutions per minute.

Spire Point: A conical pointed bullet. The line from the shank to the point is nearly straight. See the .308" 110 grain bullet in the 30 caliber rifle section for an example.

Spitzer: Bullet design feature from German for "point". A bullet with a pointed nose. The line from the shank to the tip is arched.

Stabilize: To spin a projectile around its long axis rapidly enough to keep it point on in flight.

Swage: To form by forcing into or through a die. Rhymes with "age".

Throat: That area of the bore immediately ahead of the chamber tapering to the point where the rifling starts. See also *leade* or *freebore*.

Time of Flight (TOF): The elapsed time, in seconds, of a bullet's flight from muzzle to a given range.

Trajectory: The path of the projectile in flight relative to the line of sight.

Transducer: In ammunition research, a device made of quartz which develops a voltage directly proportional to the pressure applied to it. Used to measure chamber pressures.

Twist: The angle of the rifling in relation to the axis of the bore. Usually measured by the length of barrel required to rotate a bullet one complete turn.

Upset: 1. The tendency for a bullet to become more cylindrical on firing due to inertia. Also known as *slugging*. 2. The expansion on impact of a hunting bullet. See *mushroom*.

USPSA: United States Practical Shooting Association

Varmint: A variation of "vermin". A wild animal or bird considered a pest, usually not covered by game regulations.

Velocity: The speed of a projectile. Usually measured in feet per second (fps) at a given range.

Vernier Caliper: A simple slide-type precision measuring tool used by handloaders. "Vernier" refers to the readout mechanism. The *dial caliper* is becoming more popular because its dial permits faster and less error-prone readings.

Wad: A disc of paper, felt, cork, plastic or other material used primarily in shotshells to separate powder from shot. Can be over-powder, filler or a combination of these. Speer shot capsules for handguns feature a wad to seal the bore.

Wadcutter: A cylindrical, sharp-shouldered bullet designed to cut a clean round hole in a paper target for maximum score in competition.

WCF: Winchester Center Fire. A proprietary name applied to several cartridges developed by Winchester

Web: That part of a cartridge case between the bottom of the primer pocket and the interior of the case. The web is pierced by the flash hole.

Wildcat: A cartridge formed by altering an existing commercial case to make a style that is not available from ammunition companies. SAAMI dimensional and pressure standards do not apply to wildcat cartridges.

Windage: The amount of sight correction, left or right, applied to compensate for wind deflection of a projectile.

Wind Deflection: Lateral change in the path of a projectile due to crosswind effects.

Work-hardening: The change in hardness of metal due to repeated flexing or stress. In reloading, continued sizing of a case can work-harden the metal until cracks appear. See *annealing*.

Working-up: 1. The process of developing a safe maximum load by starting with a lower powder charge and increasing it in small steps only after firing and checking for signs of pressure at each point along the way. 2. Accuracy testing of known safe loads in a step-wise manner.

Yaw: A situation where a bullet rotates on its axis at a small angle to the line of flight. In yaw, a bullet's tip is normally on the axis of the path but the base is spiraling around that axis. The *spin* of the bullet causes it to settle into stable flight with both tip and base on the same path axis, usually within 40 to 100 yards for a rifle.

Zero: More correctly, "Zero Sight Adjustment." That adjustment of a gun's sights that will place a properly aimed shot at the desired point of impact at some range with a given load, in the absence of wind. The basis from which subsequent sight adjustments are made.

Zero Range: The distance at which the bullet path exactly coincides with the line of sight (LOS). Each gun/load combination actually has two zero ranges—one near the muzzle as the bullet rises through the LOS and another at some greater distance where the bullet descends through the LOS. Normally, it is the second zero range that most shooters recognize.

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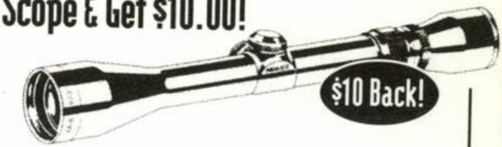

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